



Chapter 2 Management Direction

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Chapter 2 Management Direction

2.1 Development of Management Direction

In developing the management direction for the Comprehensive Conservation Plan (CCP), the Tualatin River National Wildlife Refuge (refuge) reviewed and considered a variety of natural and cultural resource, social, economic, and organizational information, ideas, and concerns important for managing the refuge. Much of this information is more fully described in Chapters 3, 4, and 5. As is appropriate for a national wildlife refuge, biological resource considerations were paramount in designing the management direction. A U.S. House of Representatives report accompanying the Refuge System Improvement Act stated, “the fundamental mission of our [Refuge] 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, habitats, and public uses, including environmental and social effects of those uses. The planning team also identified refuge areas that, due to natural or cultural considerations, were especially sensitive to public uses and facilities, and identified refuge areas that provided special opportunities for public uses.

Refuge staff met with representatives from local, state, and Federal agencies and initiated contact with elected officials and the Confederated Tribes of Grand Ronde (Tribes) to ascertain issues, priorities, problems, and recommendations as perceived by others. Refuge staff also conducted scoping meetings with agencies and the general public to ensure that comments and ideas were considered from all interested parties during development of this CCP. These consultation, coordination, and public participation efforts are more fully described in Appendix K.

The refuge planning team considered all of the above information and input, and identified and described a range of reasonable alternatives. A reasonable alternative is one that is technically and economically practical or feasible, would fulfill the purpose of and need for action without violating minimum environmental standards, and could be implemented. Each alternative was then evaluated for environmental and social effects and how it addressed the CCP issues. The refuge then identified its preferred alternative—Alternative 2—which was labeled as the Proposed Action. Following public review and comment, the U.S. Fish and Wildlife Service (the Service; USFWS) selected this CCP alternative for implementation as the management direction.

2.2 Management Directions Considered but Eliminated from Detailed Study

During development of the management direction, the refuge planning team considered the actions discussed below. All of these actions were ultimately eliminated from further evaluation and inclusion for the reasons stated.

Expanding the refuge boundary. The refuge has been protecting habitat within the approved acquisition boundary through an active effort to acquire lands and waters for almost 20 years. The approved acquisition boundary was substantially increased in 2007 with the addition of the 4,310-acre Wapato Lake Unit (USFWS 2007b). As of June 2011, the refuge has acquired or has otherwise gained management authority over approximately 2,217 acres of the 7,370 acres within the approved

refuge acquisition boundary. Acquisition is from willing sellers through fee title or easements. Of those acres 2,167 acres are in fee title or easement and 50 acres are under memorandum of agreement with Metro for management. Refuge efforts now and into the foreseeable future are focused on securing the acreage yet to be acquired within the existing boundary from willing sellers. Therefore, expansion of the approved refuge acquisition boundary is not being considered as part of this CCP effort.

The Service has recently initiated a separate study of opportunities to conserve valuable fish, wildlife, and plant habitats throughout the Willamette Valley (USFWS 2011a). This new effort is part of the national America's Great Outdoors initiative and will involve collaboration among local communities, landowners, agencies, and organizations. Purposes of the study include conserving rare habitats; enhancing habitat connectivity; helping to recover and avoid listing species with declining populations; addressing goose management issues, including agricultural depredation; enhancing water quantity and quality; and increasing wildlife-dependent recreation and education opportunities. The study will evaluate voluntary conservation easements, private land incentives, potential expansion of existing or establishment of new national wildlife refuges; and other "land protection strategies that support local economies, conserve natural resources and provide increased outdoor recreation and education opportunities" (USFWS 2011a). One of the outcomes of this study may be the possibility of establishing the existing Wapato Lake Unit as its own national wildlife refuge. Several opportunities will be provided for the public to become involved in this new study. The refuge is participating in this Willamette Valley-wide conservation effort, but the initiative is not part of this CCP.

Cropland management for geese. In its plan to reduce goose depredation of private agricultural lands, the Pacific Flyway Council (PFC) recommended, among other things, that Federal refuges do "everything possible ... to provide abundant, high quality goose forage" (PFC 1998). A task force created by the Oregon legislature in 2009 to evaluate this issue made similar recommendations and stated that, "Supplemental feeding of geese on ... federal areas should be utilized when needed to reduce goose depredation on private farmlands" (Goose Depredation Task Force 2010). Although cooperative farming is used as an interim management tool prior to restoring acquired lands, the refuge planning team considered implementation of a permanent cropland management program on the refuge to provide winter forage for geese. This proposal was eliminated from further study for the following reason:

- Restoration and management of native habitat types on these refuge acreages support higher priority ecological values (i.e., remnant vegetation communities and wildlife species with declining populations) and directly support the purposes of the refuge.

Allowing certain nonwildlife-dependent uses. Uses found not appropriate have not been carried forward in the CCP process (see discussion of the Refuge Administration Act in Section 1.5, Legal and Policy Guidance). The refuge planning team considered the appropriateness of providing opportunities for a broad range of recreational and commercial uses of the refuge that were suggested during CCP scoping or at other times prior to the start of the CCP process. These uses include dog training/walking, bicycling/jogging, plant harvesting, trapping, boat access, and geocaching.

Each of these uses was evaluated and found to cause unacceptable levels of disturbance to wildlife, create unacceptable public safety issues, and/or interfere with users engaged in compatible wildlife-dependent uses. Therefore, these uses were found to be not appropriate on the refuge, and they are

not included in the management direction. These findings are documented in Appendix A, Appropriate Use Findings.

Providing boat access to the Tualatin River at the Wapato Lake Unit. Comments were made during public scoping and the public use review regarding the potential for boating access to the Tualatin River from the Wapato Lake Unit (SWCA Environmental Consultants 2010a, 2010b).

As it flows through the northern half of the Wapato Lake Unit, the Tualatin River is quite narrow and is bordered by strips of remnant riparian forest. As a result of flooding and natural tree fall, the river is regularly blocked by multiple brush and logjams. Maneuvering even a small human-powered craft through this reach of the river would require regular lifting of the craft over or around logjams, creating a potentially dangerous situation. If the refuge developed improved boat access to the river, the public would reasonably expect a relatively safe and enjoyable boating experience, which at this time, we are unable to provide. Additionally, large woody debris is often a valuable component of aquatic fisheries habitat, and logs are best left in place to facilitate wildlife benefits. For these reasons, this proposal was determined impractical and was not further evaluated as part of this CCP.

2.3 Description of Management Direction

As a unit of the National Wildlife Refuge System (Refuge System), the refuge is managed to conserve native fish, wildlife, plants, and their habitats, and to provide opportunities for compatible wildlife-dependent public uses. The refuge will continue to conduct core management programs.

A brief description of the management direction follows. It represents a balanced approach among the many competing needs and issues that the refuge currently faces and is likely to experience in the next 15 years. Table 2-1 summarizes the features of the management direction. Maps displaying the habitat types and visitor services features associated with the management direction can be found in Appendix P. Changes in habitat types and restoration objectives were derived from the philosophy of creating larger blocks of contiguous habitat types to reduce fragmentation and increase connectivity among habitat patches, and to restore and maintain rare habitat types. In some instances we plan to eliminate small patches of rare habitat in favor of another habitat type that will result in less fragmentation. We will then enhance and/or restore more of the rare habitat type in another location to achieve the same goal.

Adaptive management. Based upon the Service's Adaptive Management Implementation policy, refuge staff shall use adaptive management for conserving, protecting, and, where appropriate, restoring lands and resources. Adaptive management is defined as a system of management practices based upon clearly identified outcomes, where monitoring evaluates whether management actions are achieving desired results (objectives). The recently published *Adaptive Management Technical Guide* also defines adaptive management as a decision process that "promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood" (Williams et al. 2009). Adaptive management accounts for the fact that complete knowledge about fish, wildlife, plants, habitats, and the ecological processes supporting them may be lacking. The role of natural variability contributing to ecological resilience also is recognized as an important principle for adaptive management. It is not a "trial and error" process; rather, adaptive management emphasizes learning while doing based upon available scientific information and best professional judgment considering site-specific biotic and abiotic factors on refuge lands.

Administration. Full implementation of the management direction, including increasing habitat restoration projects and public use opportunities, will require, at a minimum, six additional full-time permanent employees. The refuge will continue to pursue additional staff over the life of the CCP.

Appropriateness and compatibility. Consistent with relevant laws, regulations, and policies, prior to allowing any public use, including commercial use of the refuge, each such use would first need to be found appropriate and determined compatible. The Service made preliminary findings and determinations regarding the appropriateness and compatibility of each use included in the management direction. Prior to signature of a decision document for the CCP and its associated NEPA document, appropriateness findings and compatibility determinations were finalized for each public use included in the Service's management direction. Appropriateness and compatibility are further discussed in Appendices A and B.

Biological integrity. The Administration Act directs the Service to “ensure that the biological integrity, diversity, and environmental health of the [Refuge System] are maintained for the benefit of present and future generations of Americans” The policy is an additional directive for the Service to follow while achieving a refuge's purposes and the Refuge System's mission. It provides for the consideration and protection of the broad spectrum of native fish, wildlife, and habitat resources found on the refuge. When evaluating the appropriate management direction for the refuge (e.g., in compatibility determinations), the Service will use sound professional judgment to determine the refuge's contribution to biological integrity, diversity, and environmental health (BIDEH) at multiple landscape scales. Sound professional judgment will incorporate field experience, knowledge of refuge resources, an understanding of the refuge's role within the 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.”¹

Climate change. The Service considers and analyzes climate change in its decisions, long-range plans, and other activities. Habitat conditions and wildlife populations are directly and indirectly sensitive to climatic conditions, namely precipitation and temperature. As described in greater detail in Chapter 3, the area's hydrology is not particularly sensitive to changes in climate because the refuge is located in a rain-dominant system. However, increasing temperatures increase the risk of fire, disease, pests, and invasive species throughout the Pacific Northwest, and these trends may affect the refuge's forest, riparian, and upland habitats and species and their management.

The combined changes (temperature, precipitation, and hydrology) can affect the refuge's habitats and species directly, such as the timing of migratory arrival and many other phenological responses, and indirectly, such as by added vulnerability to other stressors including invasive species and pathogens. Predicting biological response at the population level, however, requires complex research and information and sophisticated models that can be validated with field studies over time. This highlights the importance of monitoring both habitats and species to establish potential correlations and adaptation options.

¹ There is one caveat, however. Management for a refuge's purpose(s) is the highest priority, so maintenance and/or restoration of biological integrity, diversity, and environmental health cannot compromise or conflict with refuge purpose(s).

In summary, climate change has the potential to significantly impact the refuge's ability to achieve its purposes, goals, and objectives. Knowledge and monitoring of these regional and local trends will be used to assess potential changes or enhancements to the refuge's management actions and techniques and/or their timing, using the adaptive management approach described above. Most notably, the region's changing climate, specifically hotter and drier summer months, could challenge the refuge's goals and objectives for maintaining, enhancing, and restoring mixed coniferous/deciduous forest habitat to a historical range of variability, and for maintaining, enhancing, and restoring native Willamette Valley wet prairie and shrub-scrub wetland habitat.

The refuge will monitor wildlife corridor analyses, vulnerability assessments, vegetative and species response modeling, and other efforts, including those underway at a landscape scale, such as the Great Northern Landscape Conservation Cooperative (LCC). LCCs are formal science-management partnerships between the Service, Federal agencies, states, Tribes, nongovernmental organizations (NGOs), universities, and other entities to address climate change and other biological stressors in an integrated fashion. LCCs provide science support, biological planning, conservation design, research, and design of inventory and monitoring programs. As needed, objectives and strategies will be adjusted to assist in enhancing refuge resources' resilience to climate change and to potentially manage for new assemblages of species in the future.

Energy efficiency, sustainability, and other green building concepts were among the key principles used in the design and construction of the refuge's Wildlife Center, environmental education shelter, and administration building in the past decade (USFWS 2003a). The refuge will continue to take steps to mitigate effects of climate change and reduce its carbon footprint to help achieve the Service's national commitment to become carbon neutral by 2020 (USFWS 2010a). Habitat restoration efforts will help to sequester carbon. Most restoration efforts involve planting grasses, shrubs, or trees, each of which will remove atmospheric carbon dioxide and store it within the plant materials. In addition, forest and scrub-shrub habitat types will increase shading along waterways, contributing to decreased water temperatures. Restoring and maintaining large blocks of habitat may also provide extended life history needs, such as cooler forest areas, for fish and wildlife as climate change occurs.

Coordination with the State. The refuge will continue to routinely coordinate with state agencies such as Oregon Department of Fish and Wildlife (ODFW), Oregon Department of Environmental Quality (DEQ), and the Department of State Lands (DSL). Key subjects of mutual interest include water quality; wetlands; management of dusky Canada geese, cackling Canada geese, and other waterfowl; goose and elk depredation; management of wildlife-dependent recreation, including hunting and fishing; management of non-native and invasive species; and management of special-status species.

Coordination with the Confederated Tribes of Grand Ronde. The refuge will continue to coordinate and consult with the Tribes on subjects of mutual interest, including education and interpretation regarding cultural resources.

Cultural resources protection and National Historic Preservation Act (NHPA) compliance. The refuge will continue to uphold federal laws protecting cultural resources, including Section 106 of the NHPA. These laws also mandate consultation with Native American Tribes, the State Historic Preservation Office, and other preservation partners.

Facility management. The efficient and safe operation of refuge facilities is critical to achievement of refuge purposes, goals, and objectives, including conserving native fish, wildlife, plants, and their habitats, and providing compatible wildlife-dependent public use opportunities. The Service will continue to maintain, repair, upgrade, and/or replace refuge facilities as necessary and appropriate, consistent with available funding.

Fees. Some public lands, including national wildlife refuges, establish and use revenues generated by entrance and user fees to help support their programs. Federal law and policy requires the use of fee revenues to support visitor services programs, including maintenance and repair of visitor facilities. The refuge has received official approval to establish an entrance fee program (USFWS 2009a), but has not implemented one to date. The refuge will continue to evaluate the desirability of establishing entrance fees to supplement Federal appropriations, grants and other less reliable funding, and volunteer support.

Funding and staffing. As a result of inflation, implementation of current management will likely require increased funding just to maintain current operations. Full implementation of the management direction will require funding levels substantially above current budget allocations to support the identified habitat and wildlife management activities and enhanced public use programs.

Aspects of the refuge's habitat and wildlife program, such as habitat restoration projects, have been funded with grants and cost-share moneys, and through mitigation and other agreements with other agencies. A much greater proportion of the refuge's visitor services program has been funded with one-time grants, cost-share programs, and funding from other outside sources. In addition, as discussed elsewhere in this chapter, both programs are supported through numerous partnership and volunteer efforts. Future programs on the refuge will continue to rely on grants, cost-share moneys, partnerships, and volunteers.

As noted at the beginning of this document, the purpose of this CCP is to provide long-term guidance for management decisions; set forth goals, objectives, and strategies needed to accomplish refuge purposes; and identify the Service's best estimates of future needs. Selection of the management direction does not constitute a commitment for staffing increases, operational and maintenance increases, continued land acquisition, or construction of new projects. After the CCP is completed, actions and programs that are part of the management direction will be implemented over a period of 15 years, consistent with available funding and staffing.

Goose management. The refuge and partner agencies including ODFW are grappling with several issues regarding goose management. Issues of concern include reduced numbers of dusky Canada geese and the abundance of cackling Canada geese, the loss of goose foraging habitat, and goose depredation on private farmland (PFC 1998, 1999, 2008). There are also concerns with increasing populations of resident Western Canada geese.

The refuge lies within the Willamette Valley and Lower Columbia River area, has agricultural lands as neighbors, and supports wintering dusky Canada geese and cackling Canada geese; thus, goose management is an important issue for the refuge. The management direction includes winter surveys of refuge goose use and winter sanctuary areas that provide resting and foraging habitats for dusky Canada geese and other waterfowl.

Habitat and wildlife. The refuge is currently composed of a mosaic of fragmented habitats. The management direction will strive to combine some of these fragments into larger contiguous blocks

of native habitat types within the landscape and also restore relic or disappearing habitat types (see Appendix P, Map 9). It will benefit imperiled species that rely on prairie, scrub-shrub wetland, and oak savanna habitats. It will capitalize on opportunities to work with regional partners and increase the continuity of habitats as well as recreational connections beyond the boundaries of the refuge.

The management direction is largely driven by the typical hydrologic flows in the Tualatin River, with limited water control manipulation on the refuge. Prescribed fire will be added as an additional habitat management technique.

The habitat types of the Tualatin River, primarily riparian forest and herbaceous wetland, will not substantially change under the management direction. In the upland, oak savanna and ruderal habitats will convert to mixed forest. The oak savanna that is currently identified on the refuge is habitat where management efforts have been made to begin converting ruderal uplands to oak savanna primarily through the treatment of invasive species and by some planting. The habitat is not mature oak savanna. However, through this CCP, the refuge has identified some areas that would provide more benefit as mixed forest. The conversion of oak savanna to mixed forest would not result in a “true” loss of oak savanna. The limited water manipulation on the Tualatin River Unit will continue. On the Rock Creek Unit, the ruderal wetlands will be converted to scrub-shrub wetland. Other actions included in the management direction intend to restore a mosaic of wetlands, riparian forests, oak savannas, prairies, and streams.

Habitats on the Riverboat Unit will largely remain the same as under current management, except that active water control management that maintains a 30-acre herbaceous wetland will be modified. The wetland will be allowed to evolve into a mixture of wet prairie and scrub-shrub wetland. Approximately 4 acres of riparian forest on this unit will convert to wet prairie.

At the Atfalat’i Unit, Chicken Creek will be restored to its historical footprint. The existing water diversion structure could be relocated to the east, allowing water management on approximately 158 acres of herbaceous wetland, 69 acres less than what is currently managed. These wetlands will be enhanced (e.g., recontouring ground surface and updating water control structures) to manage them more effectively. The remaining acres will be converted to a mixture of wet prairie, oak savanna, and scrub-shrub wetland.

Management of the Onion Flats Unit will take advantage of soils that are rare in the Willamette Valley and historically supported a rare scrub-shrub wetland type. Assuming further land acquisition occurs; Onion Flats Unit will convert from cooperative farming into a scrub-shrub wetland and oak savanna. These changes could benefit declining dusky Canada geese and the threatened Nelson’s checker-mallow plant. The management direction also include restoring channelized Rock Creek to its historical footprint.

Management of the Wapato Lake Unit could include a mixture of free-flowing hydrology and intensive water control with the intention of a more natural hydrology being implemented over the long term. Actual management activities of the lake bed will be determined based upon a Wapato Lake water management planning study.

Integrated pest management (IPM). Non-native species, especially invasive species, and other pest plants and animals can disrupt native ecosystems and management of conservation lands. They can displace native plants and create monotypic habitats of little value to native fish and wildlife; they can prey upon native species; they can transmit diseases to other species, including humans; and they

can damage facilities used to manage habitats and provide public use opportunities. Species posing the greatest current threats to the refuge include Himalayan blackberry, English ivy, common carp, bullfrogs, nutria, Bermuda grass, and reed canarygrass. Species that have been detected on the refuge but were immediately removed include Japanese knotweed and purple loosestrife. In addition, snapping turtles have been documented in the Tualatin River, but have not been observed by refuge personnel. Species that pose a significant threat to the refuge, but have not been documented, include giant hogweed, zebra mussel, garlic mustard, and New Zealand mud snail. Control of such species is a high-priority refuge management activity. Because of their aggressive nature and high potential for harm, the refuge has zero tolerance for purple loosestrife and Japanese knotweed and will continue to take immediate action to remove these species from the refuge whenever they are found.

Other pest species, both native and non-native, such as beaver, feral cats, catfish, cocklebur, mosquito fish, poison hemlock, mosquitoes, sunfish, teasel, bull thistle, Canada thistle, velvetleaf, and tansy, can also limit the refuge's ability to provide high-quality habitats and public use programs. Appropriate management actions, including control efforts, will continue to be taken for these species, consistent with need and available funding.

An IPM approach will be used, where practicable, to eradicate, control, or contain pest and invasive species (herein collectively referred to as pests) on refuge lands. IPM 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. If a pesticide is needed on refuge lands, the most specific (selective) chemical available for the target species would be used unless considerations of persistence or other environmental and/or biotic hazards preclude it. Pesticide use will be further restricted because only pesticides registered with the U.S. Environmental Protection Agency (EPA) in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) 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 refers to a biologically substantial decrease in environmental quality as indicated by a variety of potential factors such as declines in native species populations or communities, degraded habitat quality or long-term habitat loss, and/or altered ecological processes. Environmental harm may be a result of direct effects of pests on native species, including preying and feeding on them (e.g., bullfrogs eating native amphibians); causing or vectoring diseases; preventing them from reproducing or killing their young (e.g., pushing eggs out of nests); outcompeting them for food, nutrients, light, nest sites or other vital resources; or hybridizing with them so frequently that within a few generations, few if any truly native individuals remain. Environmental harm also 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 during winter.

See Appendix G for the refuge's IPM program documentation. Along with a more detailed discussion of IPM techniques, this documentation describes the selective use of pesticides for pest management on refuge lands, where necessary. Throughout the life of the CCP, most proposed pesticide uses on refuge lands will be evaluated for potential effects to refuge biological resources and environmental quality. These potential effects will be documented in "chemical profiles" (see Appendix G). Pesticide uses with appropriate and practical best management practices (BMPs) for habitat management as well as cropland/facilities maintenance would be approved for use on refuge

lands where there likely would 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 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., to counter mosquito-borne disease).

Land acquisition and habitat protection. The approved refuge boundary for the Tualatin River National Wildlife Refuge totals 7,370 acres. As of February 2013, the Service had secured management authority over 2,217 acres. This authority was secured through fee title land acquisition, purchase of conservation easements, and management agreements. During the 15-year life of the CCP, the Service will continue actively securing management authority over lands and waters within the approved refuge boundary to protect habitat for native fish, wildlife, and plants and to provide opportunities for compatible wildlife-dependent public use. This high-priority effort will be accomplished with available funding under current management authorities, and will continue to be exclusively on a willing-seller basis.

The refuge currently has a land acquisition priority plan that was developed and outlines the five priority areas for land acquisition at the Sherwood Units. There is a focus on the top three areas for acquisition, and the plan includes maps and descriptions of each area. This plan is used extensively by refuge management to develop annual funding requests and work plans in cooperation with the realty program in the Regional Office. Most importantly, this plan provides a long-term guide for future planning. Ultimately, there is an opportunistic approach to acquisition as the Service will only purchase lands from willing sellers and timing often dictates property available for purchase.

Some residences and outbuildings acquired when lands were purchased for the refuge will be used to house refuge personnel, provide offices for Service personnel, and provide storage space. Outbuildings included with newly acquired lands will be opportunistically considered for reuse (e.g., to shelter environmental education activities or store equipment and supplies) or removed.

Partnerships. It is essential to partner with others to conduct programs and accomplish goals and objectives on national wildlife refuges. Tualatin River National Wildlife Refuge actively partners with a number of organizations, including other public agencies, nonprofit conservation organizations, schools, private businesses, and others to implement current programs. Partners provide funding, equipment and supplies, special expertise, and volunteers (see further discussion below). These partnerships will continue in the future.

Public uses and facilities in Atfálat'i Unit. At least the same types of public use opportunities and facilities currently available in the Atfálat'i Unit will continue to be available in the future.

Participation in planning and review of regional development activities. The Service will continue to participate in local planning and studies pertaining to future commercial, industrial, residential, and other urban development; transportation; recreation; contamination; and other potential concerns that may affect refuge resources. This includes maintaining relationships with local jurisdictions, other agencies, and private groups to stay abreast of ongoing planning, studies and current and potential developments. Outreach and education will continue to be used to raise awareness of refuge resources and their dependence on a healthy and functioning ecosystem.

Quality recreation programs. Refuge System policy provides specific criteria for managing compatible wildlife-dependent recreational uses ([605 FW 1](#)). This policy defines quality recreational programs as ones that:

- Are safe, accessible, and available to a diversity of citizens, and use facilities that blend into the environment;
- Promote responsible behavior and compliance with laws and regulations;
- Promote stewardship and conservation, understanding and appreciation of nature, and the refuge's role in resource management and conservation;
- Provide reasonable opportunities to experience wildlife;
- Minimize conflicts with fish, wildlife, and their habitats, other public uses, and neighboring landowners; and
- Use visitor satisfaction to define and evaluate programs.

Refuge programs will be developed and managed to ensure that high-quality opportunities are provided for all visitors.

Refuge revenue sharing. The Refuge Revenue Sharing Act provides a mechanism to make payments to counties in lieu of taxes. Lands acquired by the Service are removed from county tax rolls. However, this Act, amended in 1978, allows the Service to offset the tax losses by annually paying the county or other local units of government an amount that often equals or exceeds that which would have been collected from taxes if the lands had been in private ownership. This funding is based on congressional approval on an annual basis.

Regulatory compliance. Prior to implementation, all activities in the management direction will undergo appropriate reviews and consultations. Permits and clearances will be secured as necessary to comply with legal and policy requirements.

Response to mosquito-borne disease. Mosquito populations on refuge lands will continue to be allowed to fluctuate and function unimpeded unless they pose a threat to human health. Mosquitoes inhabiting the refuge's aquatic habitats are native invertebrates that provide a forage base for fish and wildlife, including migratory birds and anadromous fish. To protect human health, the state or a local vector control agency will be allowed to control mosquito populations on refuge lands. Pesticide treatments (larvicides, pupacides, or adulticides) will be allowed on refuge lands only if local, current population monitoring and/or disease surveillance data indicate refuge-based mosquitoes pose a health threat to humans. Mosquito treatments will be in accordance with IPM principles applicable to all pests. Pesticides proposed for mosquito control will use appropriate and practical BMPs, given potential effects documented in chemical profiles. Under Service policy, pesticides may be used on refuge lands for mosquito control even though substantial effects to species and the environment are possible (i.e., exceed threshold values) in order to protect human health and safety.

The mosquito management compatibility determination in Appendix B provides details regarding allowed mosquito population monitoring, disease surveillance, and treatments. As noted earlier, Appendix G, describes the refuge's IPM program, which is applicable to all pests, including mosquitoes.

Following adoption of this CCP, the refuge will develop a disease contingency plan (DCP) to address responses to mosquito-borne disease outbreaks on and/or adjacent to refuge lands. Much of the information contained in the compatibility determination for mosquito management will be

incorporated with additional specificity, where necessary, in the DCP. The DCP will also include information on the history of mosquito-borne diseases on and/or adjacent to the Refuge as well as measures to protect refuge visitors, Service-authorized agents, and Service employees when a health threat or emergency is identified by health officials.

Restoration of ruderal habitats. The refuge contains many tracts of land that consist of fallow farmland, undeveloped lands that contain mainly non-native vegetation, or lands that are otherwise not restored to native habitat types. These lands include both uplands and wetlands in degraded condition. On many of these tracts, the refuge has begun pretreatment work to restore native habitat types. Pretreatments may include mowing, disking, removal of non-native trees, application of herbicide to remove non-native plants, or other activities. These pretreatments are conducted with the expectation that the area will be restored to specific native habitat types as described in the habitat goals listed below in this chapter. There are currently 189 acres of ruderal upland and 74 acres of ruderal wetland that will be restored to native habitat types.

Site restrictions. Selected tracts of land within the refuge boundary are encumbered with legal restrictions that limit the manner in which those tracts can be managed for fish, wildlife, and public use (see Appendix J). These site-specific limitations originate with management agreements and mitigation requirements (USFWS 1992a, 2010d). These site restrictions will continue to apply under the management direction.

Sound professional judgment. Decisions regarding refuge management and actions taken to carry out these decisions will continue to be based on sound professional judgment. Federal regulations in 16 United States Code (USC) 668-668ee define sound professional judgment as “a finding, determination, or decision that is consistent with principles of sound fish and wildlife management and administration, available science and resources, and adherence to the requirements of the National Wildlife Refuge System Administration Act of 1966 and other applicable laws. Included in this finding, determination, or decision is a refuge manager’s field experience and knowledge of the particular refuge’s resources.”

Step-down management plans. This CCP provides broad, long-range guidance for overall management of the refuge and its principal programs. Further work, including more data gathering and more detailed analyses, would be needed to develop more specific guidance for selected programs and elements. In these cases, step-down management plans will be developed. Step-down management plans will satisfy NEPA requirements and other relevant compliance requirements, and the development of these plans will include appropriate opportunities for public involvement. The following plans are scheduled for development.

Disease contingency plan. This plan will be developed in partnership with mosquito abatement, public health, and animal health authorities from the State of Oregon, Washington County, and Yamhill County. This plan will describe mosquito abatement, avian influenza, and other public and wildlife health threats. It is scheduled for completion in 2015.

Elk management plan. This plan will be developed in partnership with the Willamette Valley National Wildlife Refuge Complex and ODFW. It will describe how elk will be managed on national wildlife refuges in the Willamette Valley. Consideration of elk viewing and/or hunting opportunities, as appropriate, will be included.

Facilities management plan. This plan will be developed within 5 years of the completion of the CCP. The plan will include: 1) preparation of a historic buildings assessment; 2) evaluation of quarters buildings to determine number needed, best locations, and maintenance costs; and 3) evaluation of potential locations for a small administrative and maintenance facility at the Wapato Lake Unit.

Fire management plan. The refuge's 2008 fire management plan has been revised and updated. This updated plan addresses the need for prescribed fire to support established habitat communities and was developed in consultation with DEQ. See Appendix O for the revised fire management plan.

Inventory and monitoring plan. The Refuge System Administration Act charges the Service to "monitor the status and trends of fish, wildlife, and plants in each refuge." The refuge will participate in development of an inventory and monitoring plan as part of a larger effort in the Willamette Valley. This plan will provide guidance for establishment of baseline inventories and subsequent monitoring activities to ensure they use common standards and are conducted with appropriate statistical rigor. These inventory and monitoring efforts will be designed to address refuge information needs for adaptive management. Data gathered will feed into efforts across larger geographic areas to detect ecological changes caused by pollution, development, climate change, and other major environmental stressors.

Support the protection and recovery of federally listed, state-listed, and other special-status species. The refuge is undertaking projects to enhance and restore native prairie and savanna habitat types that may support recovery of federally and state-listed plant species, such as Bradshaw's lomatium, Kincaid's lupine, Nelson's checker-mallow, Willamette daisy, and others. Whenever possible, as these projects proceed, planting and maintenance of these species will be conducted in accordance with applicable recovery plans to help facilitate downlisting or delisting. Restoration and maintenance of in-stream, off-channel, and other habitat types may benefit various native fish species including upper Willamette River Chinook salmon, Oregon chub, Pacific lamprey, coastal cutthroat trout, and upper Willamette River steelhead. In addition, most habitat types encountered on refuge lands could support some or all life phases of any number of listed or special-status species such as bald eagle, band-tailed pigeon, Fender's blue butterfly, streaked horned lark, northern red-legged frog, northwestern pond turtle, willow flycatcher, and others. When planning and implementing various restoration projects, consideration will be given to strategies that promote healthy populations of these species.

Urban refuge. The refuge is one of a handful of urban national wildlife refuges and was one of the first in the Refuge System specifically established under the Service's Urban Refuge Policy (Smith 1991; USFWS 1996). This policy states, in part, that the primary purpose for establishing urban refuges is to:

- "foster environmental awareness and outreach programs to develop an informed and involved citizenry that will support fish and wildlife conservation";
- "... provide public use benefits associated with fish and wildlife resources that include ... bird watching, fishing, scientific research, environmental education, open space in an urban setting, and protection of cultural resources"; and
- include "education, interpretation and wildlife-oriented recreation ... opportunities for partnerships with State and local governments, private individuals, or citizens groups ... [and a] potential role of nonprofit or volunteer groups for management purposes."

In 2011, the Service published the new vision for the National Wildlife Refuge System “Conserving the Future” (USFWS 2011c) which, in part, sets forth updated recommendations for urban refuges. Recommendation 13 of the vision document “creates an urban refuge initiative that defines excellence in our existing urban refuges, establishes the framework for creating new urban refuge partnerships and implements a refuge presence in 10 demographically and geographically varied cities across America by 2015.”

The refuge will continue in the future to be managed consistently with the guidance contained in the Urban Refuge Policy and strive to achieve the new standards of excellence that result from the new vision.

Visitor services. Existing visitor service programs will remain and new opportunities will be added (see Appendix P, Map 11). A youth waterfowl hunt program will be developed in the northern portion of the Riverboat Unit. Other expanded visitor services include: one to three additional wildlife photography blinds; an environmental education off-trail study area; a fishing program from the River Overlook; and a nature exploration play area. The refuge will explore opportunities to connect to regional trail projects.

At the Wapato Lake Unit, opportunities such as hunting and other compatible wildlife-dependent recreation and interpretation will be explored as adequate land and access are acquired and habitat restoration decisions are made.

Volunteers. With the exception of law enforcement, personnel management, contracting, and select other functions prohibited by law, volunteers are involved in almost all aspects of the refuge’s habitat and wildlife, and visitor services programs. In fiscal year 2011, volunteers donated nearly 15,000 hours of support to the refuge (USFWS 2011f). This equals more than seven full-time personnel and is valued at nearly \$327,000 (national volunteer value = \$21.79/hour [Independent Sector 2011]).

As with partnerships, the level of volunteer involvement is essential to the variety, number, and quality of programs offered through the refuge. Volunteer contributions are especially valuable during times of static or declining budgets, and when grants and other funding are harder to secure. However, volunteers are not without cost. The success of the volunteer program relies heavily on management and oversight by the refuge’s visitor services manager, the Friends of the Refuge, short-term interns, and grant-funded staff. Regardless, the refuge will continue in the future to encourage and support a large and active volunteer program.

Wapato Lake conceptual management. The Wapato Lake Unit was established in 2007 to restore the historic lake bed for the purpose of improving habitat conditions for a number of native species. The Wapato Lake Unit contains portions of the Tualatin River and tributary streams that may support listed fish species, as well as migratory birds including breeding landbirds and waterfowl species. It is the intent of the Service to restore the lake bed to protect, manage, and restore habitats for migratory birds, fish, and other native wildlife of the Willamette Valley (USFWS 2007b).

Management of this unit remains mostly conceptual as further analysis of the area is required before making specific management decisions on habitat restoration and public use opportunities. Future management decisions will support the purposes for which the Tualatin River National Wildlife Refuge was established as described in the 2007 *Tualatin River National Wildlife Refuge Proposed Wapato Lake Unit Land Conservation Plan and Environmental Assessment* (USFWS 2007b).

Key factors in establishment of the unit were to:

- Contribute to efforts across the Tualatin River Basin to improve watershed health and function;
- Protect patches of remnant rare native habitat such as herbaceous and scrub-shrub wetlands;
- Allow for the restoration of rare native habitat;
- Protect migratory bird habitat, especially wintering waterfowl and breeding neotropical songbirds;
- Improve and protect habitat for anadromous fish;
- Provide opportunities for people of all ages to enjoy wildlife-dependent recreation; and
- Enhance protection of cultural resources.

Currently, the Wapato Lake Unit is composed mostly of land that has been farmed since the late 1800s and early 1900s. The land is mostly agricultural fields that, when left alone, are invaded by reed canarygrass, which ultimately forms a monoculture. Reed canarygrass is an invasive plant that likes disturbed, moist soil conditions and prevents native plants from becoming established. It does this by overcrowding the site and taking essential nutrients from the soil and water that would otherwise be used by native plants. The levees that were constructed to facilitate delivery of water to the lake bed during summer months are overrun with Himalayan blackberry. The blackberry makes it nearly impossible to navigate the levees by foot, and they are also completely inaccessible by all-terrain vehicle (ATV) or other wheeled vehicles for maintenance purposes. The canals themselves are filled with water during the winter from the creeks and also during the summer months during irrigation. These canals may contain some fish species and invertebrates. The potential for restoring this area to a mixture of riparian forest, and scrub-shrub and herbaceous wetlands, is extremely high, and it is highly likely that there will be vast benefits to trust resources, including migratory birds and listed species. Restoration of this historic lake bed would lead to a diverse and rich area that would protect, restore, and provide a diversity of habitats for migratory birds, including songbirds, wading birds, shorebirds, wintering waterfowl, and resident and anadromous fish.

To help determine the level of restoration needed at Wapato Lake, the Service has engaged the United States Geological Survey (USGS) to conduct studies to assist with the refuge's planning efforts. Actual management activities of the Wapato Lake Unit will be determined based upon adaptive management and the outcome of the Wapato Lake water management planning study.

While there are many unknowns for the future of Wapato Lake, there are some things that will occur regardless of the restoration direction the Services chooses to take. Interim goals, as defined in the 2007 *Tualatin River National Wildlife Refuge Proposed Wapato Lake Unit Land Conservation Plan and Environmental Assessment*, reflect the core mission of the Service to protect wildlife resources and the purpose for which the Wapato Lake Unit was established. The refuge will provide public use and focus on habitat restoration.

Wapato Lake Water Management Planning Study. The Service is coordinating with the USGS's Oregon Water Science Center and others to conduct studies and evaluations to support planning for the Wapato Lake Unit (Buccola et al. ca. 2010). Results from these studies will allow the refuge to better define and evaluate the effects of water management and associated habitat restoration alternatives for Wapato Lake to benefit the habitat and species, as mentioned in the above section.

Interim water management at Wapato Lake. Water retention in and discharge from Wapato Lake will continue as they have in the recent past until a more detailed habitat management plan can be completed. That is, rain and naturally inflowing water will be allowed to fill the lake bed during the fall and winter. In the spring, the lake bed will be dewatered by pumping out and discharging water into the Tualatin River to allow cooperative farming to occur as an interim form of habitat management. Ongoing maintenance and repair of existing infrastructure will occur to the best of our ability and as appropriate, and no pumped discharges will be made with the large pump between May 1 and October 31 each year without prior approval of DEQ.

Although the Service recognizes the importance of irrigation water to the farming community, the delivery of irrigation water is not part of the Refuge System's mission or the official purposes for establishing the Tualatin River National Wildlife Refuge. Federal legislation mandates that, first and foremost, the mission of the Refuge System is wildlife conservation. In addition, before being allowed, any other use of a national wildlife refuge must first be determined compatible with the purposes for establishing the refuge. Regulations and policy establish specific guidance for making this determination.

Water quality. The Tualatin River is listed as a "water quality limited" waterway and as such was assigned a series of total maximum daily loads (TMDLs) for temperature, pH, chlorophyll a, bacteria, and dissolved oxygen. The existing TMDLs are currently being revised by DEQ. The refuge will continue to work with DEQ and other partners to address issues related to water quality and TMDLs in the Tualatin River.

Wilderness review. Service policy requires that a wilderness review be completed for each refuge as part of the CCP process. This review includes three phases: inventory, study, and recommendation. If the wilderness inventory determines that some refuge lands and/or waters satisfy minimum criteria for wilderness designation, wilderness study areas are designated and the review enters the second (study) phase. See Appendix D for more information on the refuge's wilderness review, which recommended that the refuge not undergo further study for inclusion into the wilderness system because it does not meet specific criteria required for wilderness designation.

Wildlife-dependent public uses. The Improvement Act identified six wildlife-dependent public uses. They are: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. These six wildlife-dependent public uses are to be given special consideration in refuge planning and management, and opportunities to allow these six uses are to be considered in each refuge CCP.

It is expected that participation in refuge visitor service programs would instill a sense of wonder; cultivate a connection with nature; foster a lifelong relationship with the refuge and the Refuge System; encourage a conservation ethic; and enhance the public's understanding of and appreciation for fish, wildlife, plants, and their habitats, as well as of refuge management programs to conserve these biological resources.

Table 2-1. Summary of Management Direction

Key Indicators	Management Direction
Acres of Each Habitat Type Under Management Direction*	
Bottomland riparian forest	433
Mixed coniferous/deciduous forest	103
Oak savanna	147
Oak/pine woodland	43
Wet prairie	138
Herbaceous wetland	193
Scrub-shrub wetland	205
Crops and improved pastures	0
Ruderal uplands	0
Ruderal wetlands	0
Developed land (buildings, etc.)	60
Water (river)	24
Restored acres of undetermined native habitat types at Wapato Lake Unit	871
Total acres*	2,217
Miles of Each Habitat Type	
River frontage	7.2
Streams—maintain	1.4
Streams—restore	2.7
Backwater slough—maintain	0.9
Backwater slough—restore	1.6
Species Posing Management Challenges	
Non-native, invasive, and pest plants	Continue IPM, with prescribed fire. Immediate early detection and rapid response actions to eliminate purple loosestrife, giant hogweed, garlic mustard, and Japanese knotweed if found.
Non-native, invasive, and pest animals	Continue IPM, plus eliminate problem beavers, feral cats, and nutria. Immediate action to eliminate New Zealand mud snail, snapping turtle, red-eared slider, and zebra mussel if found.
Mosquitoes	Continue to allow mosquito populations on the refuge to fluctuate and function unimpeded unless they pose a threat to human health. Mosquito treatments will be in accordance with IPM principles. Develop mosquito component of disease contingency plan in cooperation with state and/or local vector control agencies.
Canada geese	Continue to provide wintering sanctuary. Work with partner agencies to implement regional plans and agreements.
Roosevelt elk	Work with partner agencies to develop elk management plan.
Management of Special-status Species	
Wetland, riparian, and upland habitats and species	Continue to support recovery of Nelson’s checker-mallow and explore options to assist recovery of other listed species.
Aquatic habitats and species	Continue to maintain and operate weirs, fish passage, and fish screening structures. Where appropriate, remove culverts and other passage barriers during restoration efforts.

Table 2-1. Summary of Management Direction

Key Indicators	Management Direction
Wapato Lake Management	
Habitat management	Interim management: Existing lake bed infrastructure will be maintained. Lake water levels and downstream discharges will continue as in the past. Long-term management will include more natural, free-flowing hydrology.
Public Information and Outreach	
General program	Expand information and outreach materials to use broader range of techniques, more diverse use of social media, and aimed at a broader audience.
Facilities and Access	
Facilities—Sherwood Units	Expand facilities to include: 1-3 additional wildlife photography blinds, 1 off-trail nature explore/play area, 1 off-trail environmental education study area. Evaluate and develop facilities management plan.
Facilities—Wapato Lake Unit	As habitat restoration proceeds, explore opportunities for hunting and other compatible wildlife-dependent recreation and interpretive facilities.
Access—Sherwood Units	Expand access to trails, blinds, and study/explore areas. Explore connecting refuge to existing regional trail systems. Conduct transportation and safety studies for new and existing access points.
Access—Wapato Lake Unit	As habitat restoration proceeds, explore opportunities for public access to portions of the unit in support of compatible wildlife-dependent recreation and education.
Refuge entrance and user fees	Refuge continues to have no entrance or user fees, but will continue to explore desirability of establishing an entrance fee. Refuge will also explore desirability of user fees in support of waterfowl hunting, photo blind use, and special events and activities.
Environmental Education	
Number of students served annually on refuge	5,000
Number of students served annually off-site	1,750
Number of youth served in informal (non-classroom-based) education programs	2,000
Number of teacher workshops offered annually	2
Outreach to schools	Expand to include schools within a 10-mile radius of Sherwood and Gaston.
Number of volunteer naturalists trained annually in support of the education program	25
Education opportunities offered near the Wapato Lake Unit	Expand to offer teacher training, education materials to be housed at local schools, and education programs/events at locations within the

Table 2-1. Summary of Management Direction

Key Indicators	Management Direction
	community (e.g., schools, parks).
Hunting and Fishing	
Hunting—Sherwood Units	Youth hunt program will be developed on the Riverboat Unit. Includes 2 to 5 hunting blinds.
Hunting—Wapato Lake Unit	Explore opportunities for waterfowl hunting in concurrence with habitat restoration planning and implementation.
Fishing	Fishing program will be developed at the existing River Overlook on the Atfálat’i Unit.
Urban Refuge Initiative	
Information clearinghouse for natural resources management	Provide information exchange on natural resource issues to encourage collaborative sharing within communities and organizations; agencies; businesses; and others.
Information clearinghouse for environmental education	Provide information exchange and materials to educators, schools, and communities, including social science research supporting the benefits of nature-based education to people, with a focus on children.
Bring more urban citizens to the refuge to experience nature.	Identify barriers to connecting urban people to natural areas; hire youth in natural resource jobs; develop a transportation strategy to bring urban audiences to the refuge.
Increase relevance of natural resources to urban citizens	Provide outreach that supports the value of natural resources for communities—for human health, economic health, watershed health; provide education materials that address conservation and community issues such as invasive species, pollinators, urban wildlife, and climate change.

*All acreage figures are based on GIS analysis using the data shown in the maps in Appendix P.

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 legal mandates (including refuge purposes) for managing a refuge, Service policies that step down from legal mandates (e.g., Improvement Act), 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 SMART (Specific, Measurable, Achievable, Results-oriented, Time-fixed) objectives that direct efforts into incremental and measurable steps toward achieving those goals. Strategies identify specific tools and actions to accomplish objectives.

The goals for Tualatin River National Wildlife Refuge for the life of the CCP are presented in the tables on the following pages. 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 in Appendix C.

Readers, please note the following:

Below each objective statement are the strategies that could be employed 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

Refer to Appendix P, Maps 8 through 11.

Goal 1: Maintain, enhance, and restore bottomland riparian habitat consistent with the historical range of variability representative of the Willamette Valley ecosystem to support breeding and migratory landbirds and other native species.

Objective 1.1 Enhance and maintain bottomland riparian forest
Throughout the life of the CCP, enhance and maintain 322 acres of bottomland riparian forest on Tualatin River National Wildlife Refuge for the benefit of breeding and migrating landbirds (e.g., Pacific slope flycatcher, yellow warbler) and a diverse assemblage of other native species (e.g., northern red-legged frog). Bottomland riparian forest is characterized by the following:
<ul style="list-style-type: none"> • >60% overstory canopy cover of trees (e.g., Oregon ash, bigleaf maple, Douglas-fir, grand fir) that are >50 feet tall (Altman 2000) • >20% understory canopy cover of trees (e.g., willow, red-osier dogwood, Pacific yew, cascara, and hazel) that are ≥12 feet tall • Habitat patches >100 feet wide along streams (Altman 2000) • 30%-80% understory cover of shrubs (e.g., snowberry, sword fern) 3-12 feet tall (Altman 2000) • Herbaceous layer dominated by native grasses and forbs • >5 snags/acre >6 inches diameter at breast height (DBH) with at least 2 per acre >10 inches DBH and 6 feet tall (Altman 2000) • <20% cover of invasive plants (e.g., reed canarygrass, Himalayan blackberry, English ivy, English holly)
Strategies Applied to Achieve Objective:
Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, cultural, and biological means, to control or eradicate invasive species (see Appendix G).
Map invasive plant distributions every 5 years, during the spring and summer months when most plants are easily identified.
Place protective tubes on naturally recruiting saplings/seedlings.
Establish a permanent biological technician position to conduct habitat maintenance and perform habitat inventory and monitoring such as vegetation parameters and wildlife species diversity and density.

Rationale: Bottomland riparian forest is a rare, native plant community in the Willamette Valley. It provides habitat for over 100 migrating and breeding landbird species (Roth et al. 2004) and summer habitat near wetlands for native amphibians. Enhancing and/or maintaining existing bottomland riparian forest will reduce additional habitat fragmentation that is occurring in the valley at large and is consistent with refuge purposes and the Service’s BIDEH Policy. It provides habitat connectivity and movement corridors for many species. Riparian areas often serve as off-channel backwater habitat for outmigrating salmonid species during winter flooding. In addition, riparian areas help to slow, absorb, and filter rainwater and runoff. Riparian areas also provide shade and woody structure to adjacent streams, rivers, and wetlands. Some of the areas to be maintained under this objective were recently restored and will not reach a mature growth form for many years. They will not achieve the full attributes described above, but will provide a diversity of benefits as they continue to grow. Riparian areas are important to achieve purposes of the refuge to conserve fish and wildlife. Mapping invasive species will provide for a targeted approach to their removal or control, and provide a basis for adaptive management when evaluating efficacy of treatments. By using IPM techniques to maintain and enhance this habitat type the refuge will provide enhanced habitat for a myriad of fish and wildlife species. Placing tree protective tubes on naturally recruiting trees will help to both identify and protect trees during invasive species control, and protect them from herbivory by deer, voles, and other species. Bottomland riparian forest is a priority habitat type listed in the Oregon Conservation Strategy (ODFW 2006).

Objective 1.2 Restore bottomland riparian forest

By 2020, bottomland riparian forest will be restored from a mixture of ruderal upland and ruderal wetland habitat types. Then these 111 acres of bottomland riparian forest will be protected and maintained on the Tualatin River National Wildlife Refuge for the benefit of breeding and migrating landbirds (e.g., Pacific slope flycatcher, yellow warbler). Mature bottomland riparian forest is characterized by the following:

- >60% overstory canopy cover of trees (e.g., Oregon ash, bigleaf maple, Douglas-fir, grand fir) that are >50 feet tall (Altman 2000)
- >20% understory canopy cover of trees (e.g., willow, red-osier dogwood, Pacific yew, cascara, and hazel) that are ≥12 feet tall
- Habitat patches >100 feet wide along streams (Altman 2000)
- 30%-80% understory cover of shrubs (e.g., snowberry, sword fern) 3-12 feet tall (Altman 2000)
- Herbaceous layer dominated by native grasses and forbs
- >5 snags/acre >6 inches DBH with at least 2 per acre >10 inches DBH and 6 feet tall (Altman 2000)
- <20% cover of invasive plants (e.g., reed canarygrass, Himalayan blackberry, English ivy, English holly)
- Swales connecting to rivers or streams to provide backwater fish habitat and species diversity

Strategies Applied to Achieve Objective:

Pretreat for 1-2 years to exhaust non-native seed bank prior to restoration actions.

Plant native tree and shrub species at a high stocking density of 870-1,450 plants/acre.

Tube and mulch around planted saplings/seedlings to prevent girdling by small mammals and browsing by deer.

Seed native herbaceous species using local genotypes, where needed.

Where appropriate, construct swales using heavy equipment to increase plant diversity and connect with the river or nearby streams providing off-channel refugia for native fish.

Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, cultural, and biological means, to control invasive species (see Appendix G).
Monitor survival and growth of planted woody species.
Map invasive plant distributions every 5 years, during the spring and summer months when most plants are easily identified.
Establish a permanent engineering equipment operator position to restore riparian forest.
<p>Rationale: See rationale for Objective 1.1.</p> <p>Pretreatment is recommended for 1-2 years prior to planting native trees and shrubs in order to remove invasive plant seed sources in the soil. Pretreatments may consist of mechanical removal (e.g., mowing, discing) of invasive plant species, and/or application of Service-approved herbicide in accordance with the IPM plan (Appendix G). Planting trees and shrubs at a high density will ensure desired attributes of canopy and shrub cover are achieved while allowing for natural mortality of newly installed plants during the first few years. To ensure successful restoration, >70% survival of woody species is needed during the first year after planting. Tubing and mulching around newly planted trees and shrubs retain soil moisture, act as a weed barrier, and prevent girdling by small mammals. Where appropriate backwater swales can be constructed to provide floodplain connection with nearby streams or rivers. Backwater swales will enhance biodiversity of the flora and fauna in the area and provide enhanced habitat attributes for native resident and anadromous fish (Jeffres et al. 2008). Restoring this floodplain connection is one of the most critical areas to achieve benefit for aquatic, riparian, and upland species (ODFW 2006). Restored areas will not reach the full attributes described during the 15-year life span of the CCP, but management will be directed toward reaching those characteristics.</p>

Goal 2: Maintain, enhance, and restore mixed coniferous/deciduous forest habitat to a historical range of variability representative of the Willamette Valley ecosystem in order to support breeding and migratory landbirds and other native species.

<p>Objective 2.1 Enhance and maintain mixed coniferous/deciduous forest</p> <p>Throughout the life of the CCP, enhance and maintain 52 acres of mixed coniferous/deciduous forest on the refuge for the benefit of breeding and migrating landbirds (e.g., orange-crowned warbler, Bewick’s wren) and a diverse assemblage of other native species (e.g., black-tailed deer, northwestern salamander, little brown bat). Mixed coniferous/deciduous forest is characterized by the following:</p> <ul style="list-style-type: none"> • 40%-60% canopy cover that is Douglas-fir–dominated with mixtures of grand fir, western red-cedar, western hemlock, bigleaf maple, Garry oak, Pacific dogwood, Pacific yew, and red alder • 10%-50% subcanopy trees (Spies and Franklin 1991) • >30% cover in understory layer <15 feet tall consisting of snowberry, hazel, sword fern, and other shrubs • >5 snags/acre >6 inches DBH with at least 2 per acre >10 inches DBH and 6 feet tall (Altman 2000) • <20% cover of non-native invasive plants (e.g., Himalayan blackberry, English ivy)
<p>Strategies Applied to Achieve Objective:</p>
Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, cultural, and biological methods, to control or eradicate invasive species (see Appendix G).
Map invasive plant distributions every 5 years, during the spring and summer months when most plants

are easily identified.
Use common forest health practices including prescribed fire and mechanical removals to create variable age structure.
Create snags, where needed, using mechanical methods (e.g., girdling).
Rationale: Mixed coniferous/deciduous forests provide valuable habitat for breeding and migrating landbirds. Cavity-nesting birds such as woodpeckers benefit from snags and dying trees. Mannan and Meslow (1984) found higher abundance of bird species in forests with more and larger snags. Fallen trees and branches provide substrate for salamanders and nutrients for future plant growth. These habitats support a diversity of other native species (deer, bats, amphibians) to meet various life history requirements. Using common forest management strategies such as prescribed fire and mechanical manipulation will allow the refuge to create uneven age structures to support a variety of species needs. These strategies also address rising fire risks due to a changing climate, specifically hotter and drier summer conditions, which are projected to continue and accelerate into the future. Mapping invasive species will provide for a targeted approach to their removal or control, and provide a basis for adaptive management when evaluating efficacy of treatments.

Objective 2.2 Restore mixed coniferous/deciduous forest
By 2017, mixed coniferous/deciduous forest will be restored from ruderal uplands and oak savanna habitat types and then these 51 acres of mixed coniferous/deciduous forest will be protected and maintained on the refuge for the benefit of breeding and migrating landbirds (e.g., orange-crowned warbler, Bewick’s wren) and a diverse assemblage of other native species (e.g., black-tailed deer, northwestern salamander, bat species). Mixed coniferous/deciduous forest is characterized by the following: <ul style="list-style-type: none"> • 40%-60% canopy cover that is Douglas-fir–dominated with mixtures of grand fir, western red-cedar, western hemlock, bigleaf maple, Garry oak, Pacific dogwood, Pacific yew, and red alder • 10%-50% subcanopy trees (Spies and Franklin 1991) • >30% cover in understory layer consisting of snowberry, hazel, sword fern, and other native shrubs • <20% cover of invasive plants (e.g., Himalayan blackberry, English ivy)
Strategies Applied to Achieve Objective:
See strategies for Objective 2.1.
Pretreat for 1-2 years to exhaust non-native seed bank prior to restoration actions.
Plant native tree and shrub species at a high stocking density of 870-1,450 plants/acre.
Tube and mulch around planted saplings/seedlings to prevent girdling by small mammals and browsing by deer.
Seed native herbaceous species using local genotypes, where needed.
Monitor survival and growth of planted woody species.
Map invasive plant distributions every 5 years, during the spring and summer months when most plants are easily identified.
Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, cultural, and biological methods, to control invasive species (see Appendix G).
Use prescribed fire as appropriate to control invasive species and reduce the build-up of unwanted fuel.

Rationale: See rationale for Objective 2.1. Restoring mixed coniferous/deciduous forest near or adjacent to existing forest could create larger tracts of contiguous forest habitat beneficial to forest-dwelling species (songbirds), creating larger travel corridors, and helping to prevent invasion from edge species such as brown-headed cowbirds. These strategies fit into refuge purposes and Service policy of maintaining biological integrity and species diversity.

Pretreatment is recommended for 1-2 years prior to planting native trees and shrubs in order to remove invasive plant seed sources in the soils. Prescribed fire could be used to control invasives and clear understories of unwanted fuels. Tubing and mulching around newly planted trees and shrubs retain soil moisture, act as a weed barrier, and prevent girdling. Planting trees and shrubs at a high density will ensure desired attributes of canopy and shrub cover are achieved while allowing for natural mortality of newly installed plants during the first few years. To ensure successful restoration, >70% survival of woody species is needed during the first year after planting. Restored areas will not reach the full attributes described during the 15-year life span of the CCP, but management will be directed toward reaching those characteristics.

Goal 3: Maintain, enhance, and restore oak habitats to a historical range of variability representative of the Willamette Valley ecosystem in order to support breeding and migratory landbirds and other native species.

Objective 3.1 Enhance and maintain oak savanna

Throughout the life of the CCP, enhance and maintain 109 acres of oak savanna on the refuge for the benefit of breeding and resident landbirds (e.g., western bluebird, white-breasted nuthatch, acorn woodpecker) and a diverse assemblage of other native species (e.g., western gray squirrel, black-tailed deer). Oak savanna is characterized by the following attributes:

- Trees dominated by widely spaced (1/acre), mature Garry oak 16->40 inches DBH with cavities (Thilenius 1968)
- Native grass and forbs <3 feet tall in understory
- Few to no woody species in understory, where tree and shrub cover is <10%
- Viable and reproducing populations of listed plant species such as Nelson’s checker-mallow
- <5% cover of invasive shrubs (e.g., Himalayan blackberry)
- <20% cover of non-native grasses (e.g., velvet grass) and <10% non-native forbs (e.g., Canada thistle, tansy)

Strategies Applied to Achieve Objective:

Use prescribed fire, with burn interval of 3-5 years, to reduce encroachment of woody species and to reduce thatch.

Plant listed species, as appropriate.

Use mechanical treatments (e.g., mowing) during late summer/early fall to promote native herbaceous ground cover.

Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, cultural, and biological methods, to control invasive species (see Appendix G).

Use mechanical thinning to reduce density of oak with removals limited to trees <15 inches DBH.

Use mechanical thinning to remove encroaching conifers, as needed.

Rationale: Oak savanna is a rare and unique habitat in the Willamette Valley that has been reduced to <1% of its historic extent; it provides habitat for migratory birds that are high priority and specific to

purposes of the refuge. Oak savanna habitat in the Willamette Valley supports five federally listed species (USFWS 2010b) and along with prairie habitats supports the greatest number of rare upland animals in the Willamette Valley (Titus et al. 1996). Fire historically maintained oak savanna habitat by removing competing vegetation and stimulating regeneration of native fire-associated plants. Fire suppression has allowed shrubs and conifers to encroach into oak savanna (ODFW 2006). Mowing during the fall season promotes native plant response while reducing the growth of undesirable trees and shrubs. Mowing during the fall will also reduce impacts to migratory birds by avoiding disturbance during their nesting cycle. Late summer/early fall prescribed fire on a rotational basis could help reduce encroachment of woody species such as Himalayan blackberry and poison oak and invigorate soil for establishment of native plants. Using IPM techniques ensures the best control of pest species with the lowest possible impact to fish and wildlife resources (Appendix G). Planting listed species will support recovery of plant and butterfly species identified in the *Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington* (USFWS 2010b).

Objective 3.2 Restore oak savanna

By 2020, oak savanna will be restored from ruderal uplands and early successional riparian forest habitat types. These 38 acres of oak savanna will be protected and maintained on the refuge for the benefit of breeding and resident landbirds (e.g., western bluebird, chipping sparrow, grasshopper sparrow) and a diverse assemblage of other native species (e.g., coyote). Oak savanna is characterized by the following attributes:

- Scattered oaks (1/acre) of individual trees (Thilenius 1968) or tight small clusters
- 60%-80% ground cover composed of native grasses and forbs
- <5% cover of invasive shrubs (e.g., Himalayan blackberry)
- <20% cover of non-native grasses (e.g., velvet grass) and <10% non-native forbs (e.g., Canada thistle, tansy)

Strategies Applied to Achieve Objective:

Pretreat for 1-2 years to exhaust non-native seed bank prior to restoration actions.

Plant acorns, seedlings, and/or potted oaks in clusters of 10-100 at a spacing of 100-300 feet between clusters (5-50/acre).

Use tubing or other protection to protect seedlings and saplings from herbivores.

Plant native grasses and forbs.

Conduct supplemental watering during first year.

Plant appropriate listed species such as Nelson’s checker-mallow and Willamette daisy.

Use prescribed fire during spring to control non-native species prior to initial planting.

Use prescribed fire during fall, with burn intervals of 3-5 years to reduce thatch and control invasive species.

Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, cultural, and biological methods, to control invasive species (see Appendix G).

Monitor plantings to determine survival and growth; replant if below target level or thin if too dense.

Rationale: See rationale for Objective 3.1. Restoring oak savanna habitat is consistent with refuge purposes, the Service’s mission to support the recovery of listed species associated with rare and unique habitat (e.g., Kincaid’s lupine, Willamette daisy), and with Service policy of maintaining BIDEH. Pretreatment will involve mowing, burning, and spraying of invasive shrub and grass species to create

open grassland settings for the establishment of native forbs and grasses associated with this habitat type, and will thus be beneficial to listed species adapted to the oak savanna community.

Prescribed fire use in the spring will help purge invasive plant seed banks prior to planting native species. Planting at a higher than desired density allows for natural mortality and provides a larger volume of oak substrate for wildlife while slow-growing oaks are small in the sapling stage. Oaks can later be thinned to achieve the final desired spacing. Placing tree protective tubes on trees will help to both identify and protect trees during invasive species control, and protect them from herbivory by deer, voles, and other species. Planting native grasses and forbs (wild flowers) is essential to restore the full suite of native vegetation for this plant community. Fall fires will be used to reduce thatch build-up and promote the health of native grass and forb communities. Protecting seedlings for up to 15 years will allow them to gain important establishment on the refuge. Intensive pretreatment is necessary to ensure establishment of a diverse native community and, in turn, the long-term success of oak savanna restoration. Planting and maintenance of listed species will aid in their recovery (USFWS 2010b).

Objective 3.3 Enhance and maintain oak/pine woodland

Throughout the life of the CCP, enhance and maintain 23 acres of oak/pine woodland on the refuge for the benefit of breeding and resident landbirds (e.g., white-breasted nuthatch, acorn woodpecker) and a diverse assemblage of other native species (e.g., western gray squirrel, black-tailed deer). Oak/pine woodland is characterized by the following attributes:

- Oaks up to 24" DBH occasionally with trees exceeding 36" DBH with a density of up to 425 trees/acre (Thilenius 1968) and ponderosa pine
- 1%-2% ground cover composed of native grasses and forbs
- 10%-80% cover of low shrubs
- <10% cover of invasive shrubs (e.g., Himalayan blackberry)
- <20% cover of non-native grasses (e.g., velvet grass) and <10% non-native forbs (e.g., Canada thistle, tansy)

Strategies Applied to Achieve Objective:

Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, cultural, and biological methods, to control or eradicate invasive species (see Appendix G).

Map invasive plant distributions every 5 years, during the spring and summer months when most plants are easily identified.

Use common forest health practices including prescribed fire and mechanical removals to create variable age structure.

Create snags, where needed, using mechanical methods (e.g., girdling).

Rationale: Maintaining oak/pine woodland habitat is consistent with refuge purposes and with Service policy of maintaining BIDEH. Maintaining an oak/pine woodland community will provide valuable habitat for breeding and migrating landbirds. Cavity-nesting birds such as woodpeckers benefit from snags and dying trees. Mannan and Meslow (1984) found higher abundance of bird species in forests with more and larger snags. Fallen trees and branches provide substrate for salamanders and nutrients for future plant growth. These habitats support a diversity of other native species (deer, bats, amphibians) to meet various life history requirements. Using common forest management strategies such as prescribed fire and mechanical manipulation will allow the refuge to create uneven age structures to support a variety of species needs. These strategies also address rising fire risks due to a changing climate, specifically hotter and drier summer conditions, which are projected to continue and accelerate into the future. Mapping invasive species will provide for a targeted approach to their removal or control, and provide a basis for adaptive management when evaluating efficacy of treatments.

Objective 3.4 Restore oak/pine woodland

By 2020, oak/pine woodland will be restored from ruderal uplands and oak savanna habitat types. These 20 acres of oak/pine woodland will be protected and maintained on the refuge for the benefit of breeding and resident landbirds (e.g., Swainson’s thrush, spotted towhee, western tanager) and a diverse assemblage of other native species (e.g., coyote). Oak/pine woodland is characterized by the following attributes:

- Oaks up to 24" DBH, occasionally with trees exceeding 36" DBH, (Thilenius 1968) and ponderosa pine, with a density of up to 425 total trees/acre
- 1%-2% ground cover composed of native grasses and forbs
- 10%-80% cover of low shrubs
- <10% cover of invasive shrubs (e.g., Himalayan blackberry)
- <20% cover of non-native grasses (e.g., velvet grass) and <10% non-native forbs (e.g., Canada thistle, tansy)

Strategies Applied to Achieve Objective:

Pretreat for 1-2 years to exhaust non-native seed bank prior to restoration actions.

Plant native tree and shrub species at a high stocking density of 870-1,450 plants/acre.

Tube and mulch around planted saplings/seedlings to prevent girdling by small mammals and browsing by deer.

Seed native herbaceous species using local genotypes, where needed.

Monitor survival and growth of planted woody species.

Map invasive plant distributions every 5 years, during the spring and summer months when most plants are easily identified.

Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, cultural, and biological methods, to control invasive species (see Appendix G).

Use prescribed fire as appropriate to control invasive species and reduce the build-up of unwanted fuel.

Rationale: Restoring oak/pine woodland habitat is consistent with refuge purposes and with Service policy of maintaining BIDEH. Pretreatment will involve mowing, burning, and spraying of invasive shrub and grass species for the establishment of native trees and shrubs associated with this habitat type, and will thus be beneficial to resident and migratory species adapted to the oak/pine woodland community.

Prescribed fire use in the spring will help purge invasive plant seed banks prior to planting native species. Planting at a higher than desired density allows for natural mortality and provides a larger volume of plant substrate for wildlife while plants are small in the sapling stage. Placing protective tubes on trees will help to both identify and protect trees during invasive species control, and protect them from herbivory by deer, voles, and other species. Protecting seedlings for up to 10 years will allow them to gain important establishment on the refuge. Intensive pretreatment is necessary to ensure establishment of a diverse native community and, in turn, the long-term success of oak/pine woodland restoration.

Goal 4: Maintain, enhance, and restore native Willamette Valley wet prairie habitat, with an emphasis on management for rare and listed plant species.

Objective 4.1 Enhance and maintain native wet prairie
<p>Throughout the life of the CCP, enhance and maintain 27 acres of wet prairie habitat on the refuge for the benefit of migratory birds (e.g., Wilson’s snipe, northern pintail, American kestrel, western meadowlark) and a diverse assemblage of other native species. Wet prairie habitats are characterized by the following:</p> <ul style="list-style-type: none"> • Diverse community of native sedges, rushes, native grasses (e.g., <i>Deschampsia</i> sp.) that may be >3 feet tall, and a diversity of native forbs (e.g., camas, blue-eyed grass, popcorn flower) (Titus et al. 1996; USFWS 2010b) • Intermittent ponding of water and saturated soils from November to April (Titus et al. 1996) • Very few scattered shrubs or trees (especially Garry oak) >66 feet apart • <5% total canopy cover of shrubs and trees • <20% cover of invasive plants (e.g., reed canarygrass, cocklebur, blackberry, Bermuda grass)
Strategies Applied to Achieve Objective:
Maintain/protect relic oaks at very low density.
Plant native grasses and forbs, where necessary, using local genotypes.
Plant appropriate listed species, such as Nelson’s checker-mallow.
Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, cultural, and biological methods, to control invasive species (see Appendix G).
Use prescribed fire at burn intervals of 3-5 years.
Conduct haying or mowing after Aug 1 to protect ground-nesting birds and reduce woody encroachment.
Evaluate the potential for prescription grazing during later growing season.
<p>Rationale: With less than 1% remaining, prairie habitats are one of the rarest plant communities in the Willamette Valley and provide important habitat for breeding and migrating birds. Loss of prairie habitat is due in large part to conversion to agriculture and urbanization as well as fire suppression during the past 150 years. Enhancing and maintaining wet prairie will support the purposes of the refuge and BIDEH. Prairie habitats support federally listed plant species including Nelson’s checker-mallow, and provide opportunities to contribute to recovery of other federally listed plants. Wet prairies generally occur in the floodplain on heavy, poorly drained soil (USFWS 2010b).</p> <p>Prescription grazing, mowing, and haying will occur in late season after seed has set and migratory bird nesting is complete. Determination of which method to use will depend on best available science, objectives, and availability of resources. Generally, haying or mowing will occur only once per year. These techniques are necessary to set back succession of woody plant species, reduce thatch, control invasive plants, and stimulate new growth of native plants. Planting listed species will support recovery of plant and butterfly species identified in the <i>Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington</i> (USFWS 2010b). Historically, many habitats such as wet prairie were maintained by disturbance. The primary disturbance was fire, but also included flooding, wind, and storms (ODFW 2006). Regular disturbance regimes are essential to maintain prairie and prevent encroachment of woody species as well as to promote a diversity of native plant species. Burning can reduce thatch and stimulate growth and health of native plants. Timing of prescribed burns will depend on the objective of the burn (e.g., reduce thatch, address invasive species), weather, and plant response to burns, and may occur during spring, late summer, or fall. Mowing may be used in some years to control</p>

the growth of woody species, but it does not reduce thatch. Mowing should be conducted after August 1 to protect ground-nesting birds. By August 1, most bird species have completed nesting and young have fledged.

Objective 4.2 Restore native wet prairie

By 2025, wet prairie will be restored from herbaceous wetland and early successional riparian forest habitat types. Then the refuge will protect and maintain 111 acres of wet prairie on the refuge for the benefit of migratory birds (e.g., Wilson’s snipe, northern pintail, green-winged teal) and a diverse assemblage of other native species. Wet prairie habitat types are characterized by the following:

- Diverse community of native sedges, rushes, and native grasses (e.g., *Deschampsia* sp.) that may be >3 feet tall, and a diversity of native forbs (e.g., camas, blue-eyed grass, popcorn flower) (Titus et al. 1996; USFWS 2010b)
- Intermittent ponding of water, and saturated soils from November to April (Titus et al. 1996)
- Very few scattered shrubs or trees (especially Garry oak) >66 feet apart
- <5% total canopy cover of shrubs and trees
- <20% cover of invasive plants (e.g., reed canarygrass, cocklebur, blackberry, Bermuda grass)

Strategies Applied to Achieve Objective:

Pretreat (e.g., herbicide, discing) for 1-2 years to exhaust non-native seed bank prior to restoration actions.

Use prescribed fire during spring to control non-native species prior to initial planting.

Plant native grasses and forbs, where necessary, using local genotypes.

Maintain/protect relic Garry oaks at low density.

Plant listed species, as appropriate.

Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, cultural, and biological methods, to control or eradicate invasive species (see Appendix G).

Where appropriate, construct swales using heavy equipment to increase plant diversity and connect with the river or nearby streams, providing off-channel refugia for native fish.

Use mechanical treatments to remove encroaching woody species.

Evaluate the potential to use prescription grazing during later growing season.

Evaluate the potential use of prescription grazing, mowing, and/or haying after Aug 1 to protect ground-nesting birds.

Use prescribed fire at burn intervals of 3-5 years.

Rationale: See rationale for Objective 4.1. Restoring wet prairie is consistent with refuge purposes and the Service’s mission to support recovery of listed species associated with this rare and unique habitat, and it fits the Service policy of BIDEH. Pretreatment will involve a rotation of herbicide, discing, and prescribed fire over a 1-2 year period to exhaust non-native seed banks and reduce aggressive invaders like reed canarygrass. This will prepare sites and better ensure the establishment of a diverse native community and, in turn, the long-term success of wet prairie. Planting listed species will aid in the recovery efforts as described in the *Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington* (USFWS 2010b). Mechanical and chemical treatments such as mowing and spraying will reduce woody species and open up ground for native grasses and forbs. Periodic prescribed burns will maintain the integrity of the wet prairie, clearing thatch, encroaching non-natives, and invigorating growth of natives species.

Restoration sites will be selected considering connectivity with existing or to-be-restored prairie, both on and off refuge lands. Intensive pretreatment is necessary to ensure establishment of a diverse native community and, in turn, the long-term success of wet prairie restoration.

Goal 5: Maintain, enhance, and restore a diversity of wetlands to support migratory landbirds, waterbirds, and shorebirds with special emphasis on wintering waterfowl.

Objective 5.1 Enhance and maintain herbaceous wetland

Throughout the life of the CCP, enhance and maintain 193 acres of herbaceous wetland for the benefit of migrating and wintering waterfowl (e.g., northern pintail, cackling Canada goose, tundra swan) and a diverse assemblage of other native species (e.g., waterbirds, shorebirds). Herbaceous wetlands are characterized by the following:

- Most wetlands with shallow water depths averaging 4-18 inches deep from October to June
- Other wetlands with deeper water averaging 18-48 inches deep, sometimes year-round
- >60% cover of desirable and/or native wetland plants including moist-soil annuals (e.g., smartweeds, wild millet, American slough grass), wapato, sedges, and rushes
- In deeper water, >50% cover of submergent plants (e.g., *Potamogeton* sp., *Callitriche* sp.)
- <20% cover of native emergent species (e.g., cattail, bulrush) that are >5 feet tall
- <30% cover of undesirable/invasive plants including reed canarygrass
- Presence of large woody debris
- Minimal damage to wetland infrastructure by nutria

Strategies Applied to Achieve Objective:

Initiate flood-up to full pool from October through December.

Irrigate, as needed, during summer to stimulate early season wetland annual plants and/or control invasive species.

Initiate drawdown of 10%-20% of seasonal wetlands in early April to provide mudflats for migrating shorebirds.

Initiate drawdown of most seasonal wetlands between May and July to stimulate germination of moist-soil annual plants.

Allow selected wetlands to dewater by natural evapotranspiration to provide extended wet season for BIDEH species.

Use mowing and/or herbicides to remove encroaching woody vegetation.

Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, water management, cultural, and biological methods, to control invasive species (see Appendix G).

Use mowing and discing as a disturbance regime to stimulate growth of desirable species.

Reconfigure water control structures and dikes/levees where necessary, to promote more precise water level management.

Install low-level berms, where necessary.

Work closely with National Oceanic and Atmospheric Administration (NOAA) Fisheries in the design and operation of flashboards, spillways, and other refuge water-control structures to enable proper operation to benefit water management without adversely affecting special-status fish species.

Use heavy equipment to recontour wetland basins to allow for complete drawdown and/or to promote water flow. Allowing for complete drainage will help reduce the presence of non-native species such as

reed canarygrass, bullfrogs, and carp.
Investigate the viability of using screens to exclude non-native species such as bullfrogs and carp from wetlands.
Use lethal control methods (e.g., shooting or trapping) to remove nutria and problem beaver.
Where necessary, plant trees along wetland boundaries to provide a buffer from disturbance such as hunting on neighboring lands.
Mow wetland margins prior to flood-up to provide waterfowl access to adjacent uplands.
Use prescribed fire to reduce extent of emergent plants and/or remove encroaching woody species (e.g., willow, ash).
Install logs, large trees, or root wads for turtle basking and waterfowl resting and preening.
Schedule strategic drawdowns to entrap invasive species such bullfrogs and carp.
<p>Rationale: Historically, herbaceous wetlands were a dominant feature on the landscape within the Willamette Valley, but considerable wetland loss has occurred due to conversion to agriculture, urban development, and changes in hydrology such as dam building and channelizing streams and rivers (Taft and Haig 2003). A multitude of native fish and other animals use wetlands for at least part of their annual life cycles. Seasonal herbaceous wetlands are essential for providing moist-soil plant food resources for migratory waterfowl and waterbirds, and amphibians and reptiles. Flood-up/drawdown scenarios provide foraging substrate for spring and fall migratory shorebirds. Maintaining most wetlands with shallow water will benefit waterfowl, shorebirds, and wading birds. Using various water management scenarios (drawdown and irrigation) will set back Bermuda grass and cocklebur growth/expansion. Summer irrigation is used to both control certain invasive species (e.g., common cocklebur) and to stimulate growth of moist-soil plants. Maintaining some wetlands with deeper water in a permanent or semipermanent condition provides habitat for overwater nesters such as pied-billed grebes, marshbirds, turtles, etc. Many shallow wetland areas will naturally convert to forested areas if encroaching vegetation were not controlled. Mowing or herbicide application is periodically required to set back woody vegetation and reinvigorate annual plants. Reconfiguring water control structures and dikes/levees, and installing low-level berms, will provide greater water-level management flexibility for wetland habitat rotations. Heavy equipment can be used to recontour wetland basins for a more diverse topography and to allow complete drawdown. Allowing for complete drawdown will help control invasive species such as carp and bullfrogs. Removal of nutria will protect management infrastructure and habitat from degradation. Native turtles will benefit from basking logs placed in many of the refuge’s wetlands.</p>

Objective 5.2 Enhance and maintain scrub-shrub wetland

Throughout the life of the CCP, enhance and maintain 20 acres of scrub-shrub wetlands on the refuge for the benefit of breeding migratory birds (e.g., willow flycatcher, red-winged blackbird, common yellowthroat, sora) and a diverse assemblage of other native species (e.g., northern red-legged frog, northwestern salamander). Scrub-shrub wetlands are characterized by the following:

- Water depths typically averaging 3-10 feet with some water remaining during most of the year
- Vegetation dominated by willow species, rose, and Douglas spirea with some Oregon ash, red-osier dogwood, black cottonwood, and other species
- Presence of large woody debris
- <20% cover of invasive plants (e.g., reed canarygrass)

Strategies Applied to Achieve Objective:

Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, cultural, and biological methods, to control invasive species (see Appendix G).

Map invasive plant distributions at least every 5 years.
Use prescribed fire to increase diversity in older stands.
Install logs, large trees, or root wads for turtle basking and waterfowl resting and preening structure.
Rationale: Scrub-shrub wetlands are a unique habitat type in the Willamette Valley, characterized mainly by peat soils. Scrub-shrub wetlands are important habitats for breeding and migrating landbirds and waterbirds. When breeding, native amphibians require these important habitats for egg mass attachment on emergent vegetation. Prescribed fire can be used to invigorate vegetation communities and to create mosaics of habitat patches where there are monotypic willow stands. Removing some willows will create openings and increase heterogeneity/diversity in habitat structure. In consideration of preserving peat soils, prescribed fire use will be timed with water inundation cycles. Changing climate, especially hotter and drier summer conditions, are projected to continue and accelerate. This could affect the ability of these wetlands to remain wet throughout the summer months, bringing potential new management needs. The refuge will monitor changing conditions and consider alternative strategies as needed, and practicable. Mapping invasive species will provide for a targeted approach to their removal or control, and provide a basis for adaptive management when evaluating efficacy of treatments.

Objective 5.3 Restore scrub-shrub wetland

By 2020, scrub-shrub wetlands will be restored from a mixture of ruderal wetlands, croplands, and herbaceous wetlands. The refuge will then protect and maintain 185 acres of scrub-shrub wetlands on the refuge for the benefit of breeding migratory birds (e.g., willow flycatcher, red-winged blackbird, common yellowthroat, sora) and a diverse assemblage of other native species (e.g., northern red-legged frog, northwestern salamander). Scrub-shrub wetlands are characterized by the following: <ul style="list-style-type: none"> • Water depths typically 3-10 feet with some water remaining during most of the year • Vegetation dominated by willow species, rose, and Douglas spirea with some Oregon ash, red-osier dogwood, and black cottonwood • Presence of large woody debris • <20% cover of invasive plants (e.g., reed canarygrass)
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Strategies Applied to Achieve Objective:

Pretreat (e.g., herbicide, prescribed fire, discing) for 1-2 years to exhaust non-native seed bank prior to restoration actions.
Create swales using heavy equipment.
Install water control structures, spillways, levees, and/or low berms as necessary.
Plant cuttings, plugs, and potted plants of native shrubs and trees.
Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, cultural, and biological methods, to control invasive species (see Appendix G).
Map invasive plant distributions at least every 5 years.
Establish a permanent refuge operations specialist position to oversee restoration and operations at the Wapato Lake Unit.
See also strategies under Objective 5.1.

Rationale: See rationale for Objective 5.2. Restoration of scrub-shrub wetlands will add and protect a significant amount of this unique habitat and associated species on the refuge in large contiguous tracts, helping to achieve refuge purposes and the Service policy of BIDEH.
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Restoration of scrub-shrub wetlands in the Onion Flats Unit is dependent on further land acquisition. Without further acquisition any restoration efforts will impact neighboring lands and restrict the full spectrum of restoration desired.

Goal 6: Maintain, enhance, and, where feasible, restore streams and off-channel backwater slough habitats in order to benefit salmonids and other native aquatic species.

Objective 6.1 Enhance and maintain streams (in-channel) and backwater sloughs (off-channel)

Throughout the life of the CCP, enhance and maintain 7.2 miles of river frontage, 1.4 miles of streams, and 0.9 mile of backwater sloughs on the refuge for the benefit of salmonids (e.g., coastal cutthroat trout, steelhead), migratory birds (e.g., belted kingfisher), and a diverse assemblage of other native species (e.g., northwestern pond turtle, mink, Pacific lamprey).

In-channel stream is characterized by the following:

- Barrier-free river and stream channels
- Intact riparian areas along the banks with shade provided by large native trees
- Coarse woody debris inputs for in-stream structure

Backwater sloughs are characterized by the following:

- Temporary flooding and draining with a connection to nearby creek or river
- <20% cover of invasive plants (e.g., reed canarygrass, Canada thistle)
- Barrier-free sloughs with connections to stream or river channels providing for access and egress for native fish species during flood events
- Coarse woody debris for slough structure

Strategies Applied to Achieve Objective:

Where fish passage barriers exist, either remove or modify barriers to allow passage, for example on an unnamed creek at the Riverboat Unit and on Rock Creek at the Rock Creek Unit.

Plant cuttings, plugs, and potted plants for native shrubs and trees as necessary.

Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, cultural, and biological methods, to control invasive species (see Appendix G).

Maintain structures that enhance fish passage in tributary streams.

Place woody debris as necessary to provide subsurface structure for native fish, and basking areas for native turtles and other wildlife.

Inventory and monitor freshwater mussels.

Where necessary install erosion control mats along river/stream banks.

Use BMPs with respect to the refuge cropland management program, including unfarmed buffers to ensure minimal runoff and erosion into streams and rivers.

Rationale: River and stream habitat at the refuge includes the mainstem of the Tualatin River, and Chicken and Rock Creeks at the Sherwood Units; the Tualatin River, Wapato, Ayers, Scoggins, Harris, and Hill Creeks at the Wapato Lake Unit; and many smaller tributary perennial and ephemeral streams. Functioning stream corridors provide access for upstream adult salmonid migration as well as downstream and off-channel migrating, foraging, and sanctuary habitat for outmigrating juvenile fish. In addition, headwater streams are important breeding areas both for salmonids and lamprey species. Intact riparian areas adjacent to river and stream channels serve many functions including providing water-

quality benefits, shade, organic matter via leaf fall, and coarse woody debris. A host of wetland-dependent wildlife species thrive along river and stream channels including beaver, mink, muskrat, belted kingfisher, and northwestern pond turtle. Removing barriers such as culverts in the Rock Creek and Riverboat Units will enhance fish passage.

Objective 6.2 Restore streams (in-channel)

By 2027, restore 2.7 miles of in-channel stream on the refuge for the benefit of salmonids (e.g., coastal cutthroat trout, steelhead), migratory birds (e.g., belted kingfisher), and a diverse assemblage of other native species (e.g., northwestern pond turtle, mink, Pacific lamprey).

In-channel stream is characterized by the following:

- Barrier-free river and stream channels
- Intact riparian areas along the banks with shade provided by large native trees
- Coarse woody debris for in-stream structure

Strategies Applied to Achieve Objective:

By 2017: Develop a restoration plan for Chicken Creek.

By 2020: Develop a restoration plan for Rock Creek.

Conduct topographic surveys to determine location and elevation of stream channel and backwater channels/sloughs.

Locate and reestablish the historic channels of perennial streams (e.g., Chicken Creek, Rock Creek).

Use heavy equipment to remove plugs to reconnect historic oxbows to channels.

Remove culverts and other fish passage barriers on tributary streams including on an unnamed stream at the Riverboat Unit and on the Rock Creek Unit.

Improve river and stream connectivity with the floodplain (e.g., through removal or relocation of levees, channelized reaches, or other features restricting seasonal inundation of the floodplain).

Plant cuttings, plugs, and potted plants for native shrubs and trees.

Maintain structures that enhance fish passage in tributary streams.

Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, cultural, and biological methods, to control invasive species (see Appendix G).

Place woody debris as necessary to provide subsurface structure for native fish, and basking areas for native turtles and other wildlife.

Install gravel bars as necessary for native fish and mussel habitat.

Use BMPs with respect to the refuge cropland management program, including unfarmed buffers, to ensure minimal runoff and erosion into streams and rivers.

Rationale: See rationale for Objective 6.1. Removing culverts and other fish passage barriers directly supports the strategies outlined by the Willamette Restoration Strategy (Jerrick 2001). Stream restoration activities will require additional analysis and regulatory compliance.

Objective 6.3 Restore backwater sloughs (off-channel)

By 2020, restore 1.6 miles of backwater sloughs on the refuge for the benefit of salmonids (e.g., coastal cutthroat trout, steelhead), migratory birds (e.g., belted kingfisher), and a diverse assemblage of other native species (e.g., northwestern pond turtle, mink, northern red-legged frog).

<p>Backwater sloughs are characterized by the following:</p> <ul style="list-style-type: none"> • Temporary flooding and draining with a connection to nearby creek or river • <20% cover of invasive plants (e.g., reed canarygrass, Canada thistle) • Barrier-free sloughs with connections to stream or river channels • Coarse woody debris for slough structure
<p>Strategies Applied to Achieve Objective:</p>
<p>Conduct topographic surveys to determine location and elevation of backwater channels/sloughs.</p>
<p>Use heavy equipment to remove plugs to reconnect historic oxbows to channels, and to create new backwater areas in conjunction with other restoration activities (See Objectives 1.2, 4.2, and 5.3).</p>
<p>Improve river and stream connectivity with the floodplain (e.g., through removal or relocation of levees, channelized reaches, or other features restricting seasonal inundation of the floodplain).</p>
<p>Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, cultural, and biological methods, to control invasive species (see Appendix G).</p>
<p>Place woody debris as necessary to provide subsurface structure for native fish, and basking areas for native turtles and other wildlife.</p>
<p>Use BMPs with respect to the refuge cropland management program, including unfarmed buffers, to ensure minimal runoff and erosion into backwater sloughs.</p>
<p>Rationale: Off-channel backwater areas have been shown to be important for spawning and juvenile rearing of native fish (Colvin et al. 2009). Henning et al. (2007) found that oxbow habitats were dominated by Coho salmon. Jeffres et al. (2008) found that Chinook salmon experienced higher growth rates in off-channel habitats than in perennial habitats. These ephemeral habitats may also provide breeding and foraging sites for amphibians such as northern red-legged frogs and northwestern salamanders. Backwater sloughs also provide a diversity of plant growth as they dry out in summer, providing a variety of benefits for native wildlife.</p>

Goal 7: Cultivate and maintain croplands as an interim measure to control non-native invasive species.

<p>Objective 7.1 Cultivate small cereal grain crops and green pasture at the Wapato Lake Unit</p>
<p>Prior to initiating restoration activities in the Wapato Lake lake bed and surrounding areas, use small grain croplands and green pastures as an interim measure to provide wildlife habitat while controlling weeds on acquired lands. Benefitting species include migrating and wintering waterfowl (e.g., tundra swan, northern pintail), raptors (e.g., northern harrier, red-tailed hawk), and landbirds (e.g., western meadowlark, savanna sparrow).</p>
<p>Small grain croplands are characterized by the following:</p> <ul style="list-style-type: none"> • Crops such as corn, wheat, barley, and oats • 70% harvested, 30% left standing • May have standing water or be completely flooded during rainy season
<p>Green pastures are characterized by the following:</p> <ul style="list-style-type: none"> • Green forage crops such as clover and grass hay • Tall grasses during spring • Short grasses during fall and winter • May have standing water or be completely flooded during rainy season

Strategies Applied to Achieve Objective:
Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, water management, cultural, and biological methods, to control invasive species (Appendix G).
Conduct cooperative farming to grow and harvest small grain crops.
Leave 30% of small grain crops standing for winter waterfowl forage.
Conduct cooperative farming to grow and harvest green pasture.
Harvest 100% of green pasture during spring/summer.
Mow green pasture to <4 inches during late summer/early fall to provide forage for migrating and wintering waterfowl.
Explore the feasibility of refuge staff conducting farming operations on part or all refuge lands in a temporary cropping program.
<p>Rationale: Growing cereal grains and green pasture on refuge lands as an interim measure helps reduce invasive plant species infestations prior to initiating restoration measures and provides benefits for migrating and wintering waterfowl, and other species. Selecting cereal grains versus green pasture is usually a decision based on market economics—which crops are most valuable to local farmers. Cooperative farming should benefit both the refuge in terms of wildlife value and the farmer in terms of economic value.</p> <p>Maintaining crops on the land prior to restoration helps control non-native invasive plant species such as reed canarygrass and Himalayan blackberry. Farming activities may include mowing, discing, application of approved herbicide, and planting of small grain crops, clover, or grass. Cooperative farming will be phased out as restoration efforts continue throughout the refuge. Acreage numbers presented in the management direction (0-871 acres) reflect the uncertainty of restoring the entire lake basin during the 15-year life span of the CCP. The range of acres suggested for restoration is due to the uncertainty of the direction of the Wapato Lake Unit restoration. Restoration will be dependent, in part, on the outcome of a hydrology study currently being conducted by the USGS.</p> <p>Conversion of croplands to native habitat types should benefit native species in the long term. Species using this area will likely transition as restoration is completed and new native habitats mature. Native fish species such as steelhead, coho, and lamprey will benefit from reconnecting the Wapato Lake lake bed with the Tualatin River and nearby tributary streams, while a host of waterfowl will benefit from restoration of herbaceous wetlands, and marsh birds and songbirds will use restored scrub-shrub wetlands.</p> <p>Cooperative farming is conducted by local growers who incur all costs associated with growing and harvesting crops. The cooperator is responsible for all aspects of farming including site preparation, seeding, application of any fertilizers or herbicides, harvesting, and any follow-up work necessary to remove the crop or prepare the field for the following year. Cooperators are required to leave a share of crops as determined by a cooperative agreement. For additional information see the compatibility determination in Appendix B.</p> <p>Harvesting green pasture is usually conducted during spring, and a follow-up cutting is conducted in fall to provide forage for wintering geese.</p> <p>Refuge staff may also conduct farming operations; however, all costs will be incurred by the refuge and all crops will be left for the benefit of wildlife.</p>

Objective 7.2 Cultivate small cereal grain crops and green pasture at the Onion Flats Unit

Use small grain croplands and green pastures as an interim measure to provide wildlife habitat while controlling weeds on acquired lands. The long-term goal for this property will be to restore native habitat types. Benefitting species include migrating and wintering waterfowl (e.g., Canada goose, northern pintail), raptors (e.g., northern harrier, red-tailed hawk), and landbirds (e.g., western meadowlark, savanna sparrow).

Small grain croplands are characterized by the following:

- Crops such as corn, wheat, barley, and oats
- 70% harvested, 30% left standing
- May have standing water or be completely flooded during rainy season

Green pastures are characterized by the following:

- Green forage crops such as clover and grass hay
- Tall grasses during spring
- Short grasses during fall and winter
- May have standing water or be completely flooded during rainy season

Strategies Applied to Achieve Objective:

Use IPM techniques, including mechanical/physical (e.g., mowing), chemical, water management, cultural, and biological methods, to control invasive species (see Appendix G).

Conduct cooperative farming to grow and harvest small grain crops.

Leave 30% of small grain crops standing for winter waterfowl forage.

Conduct cooperative farming to grow and harvest green pasture.

Harvest 100% of green pasture during spring/summer.

Mow green pasture to <4 inches during late summer/early fall to provide forage for migrating and wintering waterfowl.

Explore the feasibility of refuge staff conducting farming operations on part or all refuge lands in a temporary cropping program.

Rationale: Growing cereal grains and green pasture on refuge lands as an interim measure helps reduce invasive plant species infestations prior to initiating restoration measures and provides benefits for migrating and wintering waterfowl, and other species. Due to the nature of the Onion Flats basin, restoration of Rock Creek (see Objective 6.2) and restoration of scrub-shrub wetland (see Objective 5.3) cannot proceed until sufficient interest in land (e.g., fee title, easement, or management agreement) is secured so that neighboring landowners are not impacted by refuge actions. The acreage numbers presented in the management direction (0-105 acres) reflect the uncertainty of acquiring an interest in land and restoring the basin during the 15-year life span of the CCP.

Conversion of croplands to native habitat types should benefit native species in the long term. Species using this area will likely transition as restoration is completed and new native habitats mature. Native fish species such as cutthroat trout and lamprey would benefit from restoration of Rock Creek, while a host of marsh birds and songbirds would use restored scrub-shrub wetlands.

Selecting cereal grains versus green pasture is usually a decision based on market economics—which crops are most valuable to local farmers. Cooperative farming should benefit both the refuge, in terms of wildlife value, and the farmer, in terms of economic value.

Maintaining crops on the land prior to restoration helps control non-native invasive plant species such as reed canarygrass and Himalayan blackberry. Farming activities may include mowing, discing, application of approved herbicide, and planting of small grain crops, clover, or grass. Cooperative farming will be phased out as restoration efforts continue throughout the refuge.

Cooperative farming is conducted by local growers who incur all costs associated with growing and harvesting crops. The cooperator is responsible for all aspects of farming including site preparation, seeding, application of any fertilizers or herbicides, harvesting, and any follow-up work necessary to remove the crop or prepare the field for the following year. Cooperators are required to leave a share of crops as determined by a cooperative agreement. For additional information see the compatibility determination in Appendix B.

Harvesting green pasture is usually conducted during spring, and a follow-up cutting is conducted in fall to provide forage for wintering geese.

Refuge staff may also conduct farming operations; however, all costs will be incurred by the refuge and all crops will be left for the benefit of wildlife.

Goal 8: Collect scientific information (surveys, scientific assessments, and research) necessary to support adaptive management decisions that are associated with Goals 1-7.

Objective 8.1 Inventory and monitoring surveys

Throughout the life of the CCP, conduct high-priority inventory and monitoring surveys that evaluate resource management and public use activities to facilitate adaptive management as well as provide baseline data. These surveys contribute to the protection, enhancement, restoration, use, 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 1-7 in the CCP. These surveys will have the following attributes:

- Data collection techniques will likely have minimal animal mortality or disturbance and minimal habitat destruction
- Scale and accuracy of assessments will be appropriate for development and implementation of refuge habitat and wildlife management actions
- Minimum number of samples to meet statistical analysis requirements will be used to minimize long-term or cumulative impacts
- Proper cleaning of investigator equipment and clothing as well as quarantine methods, where necessary, will be required to minimize the potential spread or introduction of invasive species
- Projects will adhere to scientifically sound protocols for data collection, where available and applicable

Strategies Applied to Achieve Objective:

The following is a list of survey activities to support resource management decisions on the refuge. This list is not in order of priority.

Work with the Friends of the Refuge and other volunteers to conduct inventory and monitoring surveys.

Map invasive plant distributions throughout the refuge.

Monitor water levels in managed wetland basins.

Monitor survival and growth of planted woody species to evaluate restoration success as needed.
Conduct forest monitoring to assess snag density every 5 years.
Inventory and monitor restored wet prairies to gather baseline life history data and evaluate changes over time.
Monitor wetland and other vegetation types to determine management effectiveness as needed.
Monitor wintering waterfowl weekly from September 15 to March 15.
Monitor shorebirds weekly from April 1 to September 30.
Conduct monthly point count surveys for songbirds from April 1 to June 30.
Conduct songbird banding from May 1 to August 15 following Monitoring Avian Productivity and Survivorship (MAPS) protocol.
Monitor reptiles and amphibians (e.g., frogs, salamanders, turtles) as needed.
Monitor mammals as appropriate.
Inventory freshwater mussels in streams.
Monitor for listed fish species as appropriate (e.g., salmonids, lamprey).
Monitor water quality entering, within, and at discharge points of refuge wetlands.
Conduct periodic assessments to evaluate current habitat conditions.
Rationale: The Improvement Act requires the Service to “monitor the status and trends of fish, wildlife, and plants in each refuge.” Surveys will be used primarily to evaluate resource response to assess progress toward achieving refuge management objectives (under Goals 1-7 in this CCP) derived from the Refuge System mission, refuge purposes, and maintenance of BIDEH. Determining resource status and evaluating progress toward achieving objectives is essential to implementing adaptive management on Department of Interior lands. Specifically, results of surveys will be used to refine management strategies, where necessary, over time in order to achieve resource objectives. Surveys will provide the best available scientific information to promote transparent decision-making processes for resource management.

Objective 8.2 Research

Conduct high-priority research projects that provide the best science for habitat and wildlife management on and off refuge lands. Scientific findings gained through these projects will expand knowledge regarding the life history needs of species and species groups as well as identify or refine habitat and wildlife management actions. Research also will reduce uncertainty regarding wildlife and habitat responses to refuge management actions, which will help achieve desired outcomes reflected in resource management objectives and facilitate adaptive management. These research projects will have the following attributes:

- Data collection will adhere to scientifically defensible protocols, where available and applicable, in order to develop the best science for resource management
- Data collection techniques will likely have minimal animal mortality or disturbance and minimal habitat destruction
- The minimum number of samples will be collected to meet statistical analysis requirements for identification and/or experimentation to minimize long-term or cumulative impacts
- Proper cleaning methods will be used on investigator equipment and clothing, as well as quarantine methods, where necessary, to minimize the potential spread or introduction of

<p>invasive species</p> <ul style="list-style-type: none"> • Research projects will produce a summary report containing methods, results, and discussion of findings • Projects will often result in peer-reviewed articles in scientific journals and publications and/or symposiums
<p>Strategies Applied to Achieve Objective:</p>
<p>The following is a list of research projects to support resource management decisions on the refuge. This list is not comprehensive and is not in order of priority.</p>
<p>Conduct soil and topographic surveys and hydrological modeling to determine surface water interactions between river levels and floodplain elevations, with an outcome of frequency and duration of flooding within the Tualatin River floodplain to support saturation requirements for Objectives 4.1, 4.2, 5.3, 5.4, 6.1, and 6.2.</p>
<p>Conduct detailed topographic survey of Wapato Lake and surrounding areas to use in restoration planning and evaluation.</p>
<p>Conduct hydrologic survey of Wapato Lake and the surrounding watershed to use in restoration planning and evaluation.</p>
<p>Conduct studies to determine water quality parameters within refuge impoundments, and the effects to water quality on streams and the Tualatin River.</p>
<p>Conduct study to evaluate timing of prescribed fire to best promote native herbaceous cover and control invasive plants.</p>
<p>Conduct studies to determine practical techniques (grazing, haying, mowing, herbicide application) for habitat management.</p>
<p>Conduct studies to determine BMPs for eradicating or controlling non-native invasive species.</p>
<p>Conduct studies of disturbance to wildlife from public use activities to determine compatibility and recommend any necessary modifications to reduce disturbance.</p>
<p>Investigate methods for reducing competition from non-native fish species in stream and floodplain habitat types.</p>
<p>Investigate species and habitat sensitivity to changing climate trends and climate vulnerability assessments; monitor results of climate modeling by University of Washington and others.</p>
<p>Partner with universities and other academic institutions to conduct scientific research.</p>
<p>Partner with USGS, other Federal and state agencies, and nongovernmental organizations to conduct research studies.</p>
<p>Rationale: Research projects on refuge lands will address a wide range of natural and cultural resource as well as public use management issues. Examples of research projects include habitat use and life history requirements for specific species/species groups, practical methods for habitat management and restoration, extent and severity of environmental contaminants, techniques to control or eradicate pest species, effects of climate change on environmental conditions and associated habitat/wildlife response, identification and analyses of paleontological specimens, modeling of wildlife populations, and assessing response of habitat/wildlife to disturbance from public uses. Projects may be species-specific or refuge-specific, or they may evaluate the relative contribution of the refuge to issues and trends affecting the larger landscape (e.g., ecoregion, region, flyway, national, international). Like monitoring, results of research projects would expand the best available scientific information and potentially reduce uncertainties to promote transparent decision-making processes for resource management over time on refuge lands. In combination with results of surveys, research will promote adaptive management on refuge lands. Scientific publications resulting from research on refuge lands will help increase the visibility of the Refuge System as a leader in the development of the best science for resource conservation and management.</p>

Goal 9: Protect and manage the refuge’s unique cultural resources for their cultural, scientific, and educational values, while consulting with appropriate Native American groups and preservation organizations and complying with historic preservation legislation.

Objective 9.1 Inventory, evaluate, monitor, and protect cultural resources to improve cultural resource management
Continue and improve cultural resource management that meets the requirements of the National Historic Preservation Act (NHPA), including consultation, identification, inventorying, monitoring, and protection of cultural resources.
Strategies Applied to Achieve Objective:
Through partnerships, expand on current cultural resource inventories in high probability areas on existing lands and newly acquired lands.
Develop partnership with the Tribes for cultural resource inventory, evaluation, and project monitoring, consistent with the regulations of the NHPA. Protect all identifiable archaeological sites by avoiding disturbance within the area.
Evaluate sites for eligibility for the National Register of Historic Places (NRHP).
Continue to identify cultural resources that coincide with existing and planned roads, facilities, public use areas, habitat projects, and research projects. Plan and implement activities to avoid or mitigate impacts as necessary.
Complete a comprehensive cultural review of the refuge and compile all site surveys, work requests, and reports for easy access by managers.
When funding is limited, low priority and unsafe buildings should be cataloged and considered for removal.
Monitor known archaeological and historical sites, as needed.
Provide refuge staff with training on managing historic, archaeological, and cultural resources.
Develop and implement a museum management plan (including inventory, storage, and use) for existing and new property.
Collect and catalog oral histories from local community members.
Rationale: Various Federal historic preservation laws and regulations, such as the Archaeological Resources Protection Act of 1979 and the NHPA, require the Service to implement the kind of program described under this objective. The refuge has currently identified numerous historic structures and archaeological sites throughout the refuge related to pioneer agriculture. The refuge has also been identified as a long-term occupation area of the Kalapuyan Tribe, and several prehistoric sites have also been discovered. This objective will serve to protect these important cultural resources. Developing a partnership with the Tribes would foster greater understanding of not only the refuge’s cultural heritage, but the greater Willamette Valley region as well.

Objective 9.2 Provide interpretive and educational programs on the refuge’s cultural resources
Expand education and interpretation for cultural resources through programs and materials that highlight the rich cultural heritage of the Tualatin River watershed and the Willamette Valley. Encourage understanding and appreciation of the relationships of past and present human interactions with wildlife and their habitats.
Strategies Applied to Achieve Objective:
Develop and strengthen partnership with the Tribes in order to provide high-quality educational and interpretive programs with a focus on natural and cultural resources of the refuge and the Tualatin River

watershed.
Consult with the Tribes and other preservation partners to identify the type of cultural resources information appropriate for public interpretation.
Expand the Wildlife Center exhibits to include exhibits highlighting Native American history and Euro-American land use.
Develop interpretive media (e.g., pamphlets, signs, and exhibits) that relate to cultural resources and the refuge.
Rationale: Preservation and protection of our cultural resources requires attention not only from the refuge but the public as well. Interpretation of these resources can raise public interest and appreciation for the rich history of the peoples who lived in the valley in earlier times and how they shaped the landscape the refuge now manages. This appreciation can lead to public support for the conservation, maintenance, identification, and protection of archaeological and historic sites.

Goal 10: Provide visitors, local residents, volunteers, and partners with opportunities to understand and appreciate fish and wildlife conservation as well as the purpose, ecology, and management of the refuge and the Refuge System.

Objective 10.1 Provide visitors with clear and accurate information
Visitors will be provided with clear and accurate information that will: <ul style="list-style-type: none"> • Describe what areas are open to the public • Articulate activities that are allowed and those that are prohibited and why • Describe how to safely and ethically experience the refuge • Be presented in a variety of graphic and written formats
Strategies Applied to Achieve Objective:
Provide informational signs and brochures, regulatory information, and trail maps.
Partner with others to keep the refuge Wildlife Center open a minimum of 5 days a week.
Maintain a refuge website that meets Service web standards.
Provide at least annual training for Wildlife Center volunteers and volunteer rovers to ensure they provide quality service and are well informed about the refuge, its resources, and rules and regulations.
Maintain all existing public use facilities.
Explore opportunities for one or two informational kiosks at or near the Wapato Lake Unit.
Hire a full-time, permanent law enforcement officer to provide both visitor and resource protection.
Rationale: Kiosks, signs, publications, and contact with refuge staff and volunteers are effective communication tools to welcome and orient visitors. These steps are necessary to provide a safe and enjoyable visit that both meets visitor needs and communicates what public use opportunities and facilities are available at the refuge. In addition, clear regulations and guidance promotes protection of refuge resources, reduces law enforcement violations, and maintains compatibility. A full-time law enforcement officer will provide greater protection of visitors and natural and cultural resources.

Objective 10.2 Conduct outreach and special events

Conduct outreach and special events that:

- Describe the refuge and its place as part of the Refuge System
- Promote understanding of the refuge’s role in enhancing natural resources, protecting habitats and water quality, and providing educational and economic benefits to the community
- Describe how the refuge is different from local parks
- Focus on local residents, with an emphasis on serving urban and underserved populations, and families and youth that may not otherwise have opportunities to engage in programs about or activities on national wildlife refuges

Strategies Applied to Achieve Objective:

Partner with Friends of the Refuge and others to offer special programs and events to draw neighbors, area residents, and community partners to the refuge. Examples of events include Tualatin River Bird Festival, National Wildlife Refuge Week, and Spring Break Exploration Days.

Maintain a presence at community events where there is a high potential for delivering refuge messages. Examples include local county fairs, nature festivals, city events, and farmers’ markets.

Develop a volunteer speakers’ bureau to deliver presentations to local groups.

By 2015, investigate and develop a plan to use new/social media to expand refuge outreach.

Regularly use media like newspapers, television, magazines, and radio. Focus on news venues, as well as specialty outdoor, commerce, and travel venues.

Rationale: The area surrounding the refuge is becoming increasingly developed, and the population is expanding. The refuge opened to the public in 2006 and is still relatively unknown to many area residents and businesses. Outreach is needed for these new and growing audiences, in order to build interest in the refuge, bring visitors to the refuge, and build support for refuge programs and fish and wildlife conservation.

Objective 10.3 Plan for continuing and new public use opportunities

Plan for continuing and new public use opportunities that:

- Emphasize the role that national wildlife refuges have in the conservation of fish and wildlife and their habitats
- Prescribe a wide range of techniques and media that appeal to culturally and ethnically diverse audiences and can adapt to changing trends
- Allow visitors to experience a variety of refuge habitats and associated wildlife
- Ensure that public uses are accessible and adhere to the guidelines set forth in the Architectural Barriers Act

Strategies Applied to Achieve Objective:

By 2016, develop primary refuge interpretive, outreach, and educational themes.

By 2016, identify target audiences through a variety of means including demographic studies.

Use the Refuge System’s visitor survey (USFWS and USGS, OMB #1018-0145) or other valid and approved method to gather information about visitors and their expectations and experiences. Use data to identify areas of growing public interests and to provide the information necessary to exercise adaptive management.

Use the Refuge System Visitor Estimation Workbook (USFWS 2005a), traffic counters, and program

attendance to estimate numbers of visitors participating in public use activities.
At least every 5 years, conduct an evaluation using <i>Visitor Services Standards: A Handbook for Evaluating Visitor Service Programs</i> (USFWS 2009b) for all visitor services programs of the refuge. Conduct evaluations of new programs within 1 year of implementation.
Every 3 years, invite an organization such as Access Recreation in Portland to conduct a courtesy accessibility evaluation of public use facilities. Develop and implement a plan to make needed corrections or improvements based on this evaluation.
By 2017, develop a comprehensive visitor services plan that prescribes all public use facilities and programs at both the Sherwood Units and the Wapato Lake Unit. Complete all relevant appropriateness and compatibility determinations.
Rationale: Established under the Urban Refuge Policy, the Tualatin River National Wildlife Refuge has a special role in sharing the mission of the Refuge System, how refuges are managed throughout the Refuge System, and how citizens can learn more about and support the Refuge System as a whole. Public use opportunities need to be designed and planned in a way that is aligned with primary messages. Opportunities that do not support primary messages should be eliminated from consideration. A comprehensive visitor services plan will use primary refuge messages and themes to prescribe long-term wildlife-dependent public use programs and the facilities that will support those programs. Examples of programs could include, but may not be limited to, wildlife observation areas, trails, interpretive exhibits, signs, photography blinds, auto tour routes, education study sites, and hunting and fishing facilities.

Objective 10.4 Improve and enhance public access to, from, and within the refuge

Improve and enhance public access to, from, and within the refuge in a manner that: <ul style="list-style-type: none"> • Is safe, well marked, and accessible where feasible • Promotes the use of alternative transportation to visit the refuge, thereby helping to reduce the refuge’s carbon footprint • Poses minimal conflict with wildlife and habitat objectives • Promotes stewardship and conservation • Is coordinated with local communities and agencies planning transportation corridors near the refuge
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Strategies Applied to Achieve Objective:

Continue to work with regional and local organizations to connect the refuge to existing and proposed land-based and water-based trail systems, such as Sherwood’s Cedar Creek Trail (Otak 2009), Metro’s Tonquin Trail, and Tualatin Riverkeepers’ Tualatin River Water Trail, where feasible and compatible at existing refuge access points.
Partner with interested parties/organizations to identify potential locations for one public river access for nonmotorized boats in or near the refuge.
By 2015, partner with Oregon Department of Transportation (ODOT), local counties, TriMet, and the Western Federal Lands Highway Division of the Federal Highway Administration to conduct transportation access and safety studies for the existing refuge access from Highway 99W and Roy Rogers Road and any proposed new access points to the Sherwood Units.
If determined necessary, partner with transportation agencies to improve safety of existing access points.

Rationale: The demand for increased, enhanced, and improved public access to the refuge was a common theme of many public comments during scoping for the CCP. These comments also reflect a desire for improved public access within the refuge and for connectivity with existing and proposed land and water trails.

At present, public access to the refuge is primarily by automobile along Highway 99W and Roy Rogers Road, and by TriMet bus along Highway 99W. Of particular concern, the Highway 99W entrance was constructed in 2006 without a deceleration lane. This current entrance design was required by ODOT specifications and permit conditions, and the entrance resides within ODOT's right-of-way. Refuge visitors continue to express concern that the Highway 99W entrance is unsafe. This entrance warrants further evaluation and potential remedy.

Objective 10.5 Maintain a volunteer and internship program

Maintain a volunteer and internship program that:

- Assists with the habitat, biological, public use, maintenance, and administrative programs of the refuge
- Provides opportunities for citizens to engage in, learn about, and conduct the work of conservation
- Builds capacity to recruit, train, manage, and retain volunteers over the long term
- Fosters the development of conservation professionals

Strategies Applied to Achieve Objective:

Hire a full-time, permanent volunteer coordinator to manage current and expanding refuge-wide volunteer program.

Develop and conduct an annual refuge-wide volunteer needs assessment.

Develop a package of position descriptions that clearly define the responsibilities and roles of volunteers in all relevant refuge programs.

Continue to provide opportunities for young adults to gain work experience in natural and cultural resources planning and management, as well as visitor services management, and to explore career options in conservation fields. These opportunities may include programs such as internships, AmeriCorps placements, student employment and work/study programs, Youth Conservation Corps, and other youth employment initiatives.

Develop written training programs, manuals, and other resource training for volunteers.

Establish an advisory committee of volunteers that helps the refuge with oversight and day-to-day management of volunteer activities.

Construct a new bunkhouse and two recreational vehicle (RV) pads (with hookups) on the Tualatin River Unit near the maintenance facility to house volunteers.

Host annual volunteer appreciation event.

Rationale: Volunteers are necessary to meet the operational needs of the refuge. In fiscal year 2011, volunteers donated nearly 15,000 hours of support to the refuge (USFWS 2011f). This equals more than seven full-time personnel and is valued at nearly \$327,000 (national volunteer value = \$21.79/hour [Independent Sector 2011]). Expansion of the current volunteer program to fully meet the needs of the refuge over the life of the CCP will require a full-time volunteer coordinator. This need could be met through direct hiring of USFWS staff or by partnering with Friends of the Refuge to hire personnel.

It is critical for the Service to attract and nurture the future workforce in natural resource conservation. This priority is also reflected in the Department of Interior's Youth in the Great Outdoors initiative.

Objective 10.6 Maintain a close working relationship with the Friends of the Refuge
Maintain a relationship in which the Friends of the Refuge: <ul style="list-style-type: none"> • Assist with the refuge’s habitat, biological, public use, and maintenance programs • Seek grants, funding, and sponsorships to support refuge programs
Strategies Applied to Achieve Objective:
Work with the Friends of the Refuge to establish a chapter that will provide support for the developing Wapato Lake Unit.
Continue to provide the Friends of the Refuge with office and storage space to successfully conduct their activities.
Maintain the current memorandum of understanding between the Service and the Friends of the Refuge.
Rationale: The Friends of Tualatin River National Wildlife Refuge is a nonprofit 501(c)(3) organization whose mission is to “support the Tualatin River National Wildlife Refuge.” It is “dedicated to the protection and restoration of the refuge for the benefit of fish and wildlife, and for public education and recreation” (Friends of the Tualatin Refuge 2011). The Friends provide critical support to the refuge, supporting programs and activities that would otherwise not be feasible to conduct.
The refuge maintains a memorandum of understanding with the Friends of the Refuge, partially under the authority of the Refuge System Volunteer and Community Partnership Enhancement Act of 1998.

Goal 11: Provide students and educators from the greater Portland area with compatible and high-quality opportunities to participate in environmental education.

Objective 11.1 Increase participation in the refuge’s environmental education program
The goals for the refuge’s environmental education program are to: <ul style="list-style-type: none"> • Remain of high quality • Not exceed capacity of refuge public use facilities • Coordinate with other regional natural areas and organizations that offer environmental education
Strategies Applied to Achieve Objective:
Hire a permanent, full-time environmental education specialist to manage all refuge education and interpretation programs.
Throughout the life of the CCP, increase the number of students participating in educator-led field trips from an average of 1,900 to at least 5,000 per year.
Throughout the life of the CCP, increase the number of students reached at off-site activities and events from an average of 700 to at least 1,750 per year.
Throughout the life of the CCP, increase the number of volunteers trained in support of the environmental education program from an average of 10 to at least 25 per year.
Offer programs that are tailored to youth outside of the traditional classroom (e.g., scouts, clubs). Increase the numbers of youth participating in these programs from an average of 800 to at least 2,000 per year.
Increase outreach about the refuge’s environmental education program to teachers and administrators at schools within a 10-mile radius of Sherwood and of Gaston.
Continue to require teacher workshops prior to educators bringing class field trips to the refuge. Offer a

<p>minimum of two teacher workshops annually.</p>
<p>By 2013, identify one off-trail area that students can use, when approved as part of a field trip registration and supervised by volunteers, to conduct educational activities.</p>
<p>By 2018, design and construct one off-trail nature exploration area that engages young children to experience unstructured outdoor play.</p>
<p>Rationale: Environmental education activities promote appreciation and knowledge of natural resources, foster a conservation ethic, and aid in understanding the important role people have in the environment. Ultimately, the highest goal of environmental education is to foster an aware and involved citizenry that takes an active role in conservation efforts. As such, environmental education is identified as one of the priority public uses of the Refuge System and, as an urban national wildlife refuge, is one of the top goals for the Tualatin River National Wildlife Refuge. Expanding the current environmental education program will reach more students and educators and foster integration into local school curricula. The current education program is carried primarily through internships, grants, and volunteers, and maintaining its current capacity is dependent on soft funding, which is funding that may or may not be available each year. Permanent maintenance of the current program and future increase in participation is dependent on hiring a full-time professional environmental education coordinator.</p> <p>Nature explore areas provide opportunities for children to experience nature first-hand through unstructured outdoor play. Richard Louv identified the importance of first-hand unstructured experience in nature and the prevalence of “nature deficit disorder” as a serious issue in his book <i>Last Child in the Woods</i> (Louv 2005). Research supports Louv’s arguments demonstrating that children’s positive encounters with nature can lead to development of an environmental ethic (Chawla 1988; Palmberg and Kuru 2000; Wilson 1997).</p>

<p>Objective 11.2 Expand the environmental education program to include the Wapato Lake Unit</p>
<p>Same as Objective 11.1.</p>
<p>Strategies Applied to Achieve Objective:</p>
<p>By 2013, provide teacher training and curricula to educators within the schools and communities surrounding the Wapato Lake Unit.</p>
<p>By 2013, provide environmental education materials to educators in schools and communities surrounding the Wapato Lake Unit.</p>
<p>Explore the potential to partner with the City of Gaston to provide space and/or facilities for environmental education programs to occur at Brown Park.</p>
<p>By 2014, annually host at least two environmental education programs with the Tribes at the Wapato Lake Unit, both for tribal students and surrounding communities.</p>
<p>Rationale: Schools close to the Wapato Lake Unit offer a new audience that has yet to participate in refuge environmental education programs. The community, especially Gaston, has expressed a desire to have students learn about and experience the refuge. Although there are currently no public use facilities at the Wapato Lake Unit, the refuge can offer high-quality environmental education activities at schools, within the local community, and at the Atfalat’i Unit of the refuge.</p>

Objective 11.3 Ensure that the environmental education program is high quality

The environmental education program should:

- Align with grade-level curricula and be age appropriate
- Correlate with national and state educational standards
- Use current and widely accepted techniques
- Appeal to a broad range of learning styles and provide interdisciplinary opportunities that link natural resources through all academic subject areas
- Incorporates landscape-level conservation issues (e.g. climate change, invasive species) in ways that are relevant to students and are presented in an age-appropriate manner
- Serve students across a range of economic, social, cultural, and ethnic diversity
- Be conducted to minimize impacts to fish, wildlife, plants, and their habitats; other compatible public uses; and refuge management programs and facilities
- Involve local communities, Friends of the Refuge, volunteers, and other partners
- Incorporate the importance of the Refuge System and the purposes, goals, and objectives of the refuge
- Provide experiences that are hands-on and integrate the resources of the refuge

Strategies Applied to Achieve Objective:

Conduct at least one training per year to ensure volunteers use high-quality and appropriate educational methods, techniques, and tools.

Loan educators and schools relevant supplies and materials such as binoculars, field guides, lesson kits, and water testing kits to support on-site field activities for environmental education.

Develop a training program for parent chaperones who accompany student field trips to the refuge.

Align refuge education materials, curricula, and techniques with the Oregon Environmental Literacy Plan, as appropriate. (Oregon Environmental Literacy Task Force 2010).

At least every 5 years, conduct a comprehensive evaluation of the environmental education program using the Guidelines for Excellence established by North American Association for Environmental Education ([NAAEE] 2004).

Explore the potential to extend the teacher-training program from 1-day workshops to long-term, one-on-one coaching with individual teachers.

Maintain memberships in organizations such as NAAEE, Environmental Education Association of Oregon, Portland’s Regional Environmental Education Network, and Metro’s Intertwine.

Rationale: Environmental education opportunities in the greater Portland area are plentiful, although few provide natural areas with facilities that accommodate student field trips (with shelter, classroom, and study areas) while also providing quality wildlife-oriented education opportunities. In addition, the past and projected population boom in proximity to the refuge may continue to create a larger demand for nature-based education programs within a short bus trip from local schools. However, several key factors limit schools’ abilities to offer environmental education without the assistance of outside resources such as the refuge. At this time, environmental education is not mandated by the State of Oregon; teachers are increasingly pressured to meet current mandates and may not have the time to build skills, learn curricula, and seek out environmental education activities. Declining school budgets often limit teachers in their ability to provide transportation, cover substitute fees, purchase materials, and defray other costs associated with off-site field trips. By maintaining a high-quality education program, the refuge can offset these limitations in order to meet our environmental education goal. Education programs will be effective and offered in a way that will both attract educators and meet the learning mandates and objectives that schools are responsible for providing. The refuge can provide environmental education teaching materials (binoculars, field guides, water test kits, study skins, etc.) that schools would likely not have access to. In addition, the refuge can offer programs for youth outside the formal classroom (such as scouts and after-

school clubs) that are more affordable and not subject to daily limitations of the school day. Ensuring the long-term quality of the environmental education program, through evaluation and adaptive management, is dependent on the hiring of a full-time professional environmental education coordinator.

Goal 12: Provide refuge visitors with diverse, compatible, and high-quality opportunities to participate in wildlife-dependent recreation and interpretation.

Objective 12.1 Provide high-quality wildlife observation and wildlife photography opportunities

Provide high-quality wildlife observation and photography opportunities that:

- Focus on major wildlife species and groups of wildlife species, including migratory birds
- Incorporate a diversity of habitats found on the refuge
- Use various types of facilities to view/photograph wildlife and their habitats
- Are emphasized on a year-round basis
- Satisfy a range of skill sets, from casual and beginning observers/photographers, to advanced and expert observers/photographers

Strategies Applied to Achieve Objective:

Enhance and maintain the existing seven wildlife observation structures, 1.1 miles of year-round trails, 3.1 miles of seasonal trails, one wildlife photography blind, and two restrooms.

Maintain seasonal trail closure from October 1 to April 30 on the Atfálat’i Unit to provide sanctuary for wintering waterfowl and maintain quality viewing opportunities.

Improve habitat conditions and maintain viewing “lanes” in close proximity to wildlife observation/photography facilities. These improvements could include items such as snag/log placements; removal of branches, trees, or other encroaching vegetation; and control of non-native vegetation within wetlands.

Explore the possibility of adding a material or substance to trail surfaces to both reduce the sound of footsteps on the trail and reduce weed encroachment.

Improve 400 feet of existing year-round trail to avoid winter flooding.

Explore adding trees and/or other vegetation along busy road corridors to reduce noise and create a more natural setting.

By 2016, construct and maintain one to three additional wildlife photography blinds and associated access trails on the Atfálat’i Unit of the refuge. Manage use through a reservation system.

Partner with the Friends of the Refuge, Tualatin River Photographic Society, and local wildlife organizations to assist with the funding, design, construction, maintenance, and management of new and existing wildlife observation and photography facilities.

Explore the desirability of user fees to help operate the wildlife observation and photography program, and maintain and repair associated facilities.

Maintain wildlife “Discovery Packs” for visitors to check out at the Wildlife Center. Packs will contain binoculars, field guides, and activities for outdoor nature exploration.

Maintain an up-to-date and accurate Watchable Wildlife leaflet and checklist of birds, mammals, reptiles, and amphibians.

Partner with Friends of the Refuge, Tualatin River Photographic Society, local wildlife organizations, agencies, and/or universities to offer regular programs on the Refuge oriented to increasing the knowledge and skills of wildlife observers and photographers. Evaluate the potential for revenue from a modest program-specific fee to support such programs.

At least every 5 years, conduct an evaluation of the wildlife observation and photography program using the Refuge System Birder Friendly Refuge criteria (USFWS 2008a).

Rationale: Opportunities to participate in wildlife observation and photography in the greater Portland area are plentiful. However, many areas lack the diversity and abundance of wildlife and the expanses that the refuge offers. The refuge also provides a relatively unique location for high-quality wildlife observation and photography by limiting nonwildlife-dependent activities such as biking, jogging, dog walking, and other activities that may otherwise conflict with and disturb wildlife. Wildlife observation and photography programs are designed to provide a diversity of wildlife viewing opportunities in a manner that minimizes disturbance to wildlife. Many of the various wildlife observation facilities provide excellent photography opportunities. In addition, the refuge has one existing photography blind that can be reserved on a first-come, first-served basis, on Wednesdays, Saturdays, and Sundays throughout the year. The 0.2-mile spur trail to the photography blind is closed to all other users during the winter seasonal trail closure period. Demand for the blind is growing. Wildlife photographers have expressed concern that the blind does not offer a consistent quality experience because it faces south and photographs must be taken toward the sun most times during the day. Opportunities may exist to offer additional photography blinds that do not face the sun.

A 400-foot section of the year-round trail, located between the River Overlook and the riparian forest, floods during most winters—sometimes with water up to 16 inches deep. Pedestrians are forced to walk around the puddles and cause substantial trampling of vegetation. This section is impassable by strollers or wheelchairs when flooded. The trail section could be improved by relocating the trail farther toward the river, by building a boardwalk, or by raising the trail surface.

Maintaining the existing public use seasonal trail closures from October 1 to April 30 would help provide needed sanctuary for wintering waterfowl, and other wildlife such as the bald eagles, in support of refuge purposes.

Objective 12.2 Provide high-quality interpretive programs

Provide high-quality interpretive programs that:

- Follow the basic tenets of interpretation as defined in the Interpretive Process Model (Larsen 2003)
- Incorporate a variety of materials and technology into interpretive materials, such as signs, publications, exhibits, and direct contact with staff and volunteers
- Appeal to a variety of learning styles and facilitate self-discovery
- Convey the key messages and purposes of the refuge
- Explore interconnection of the natural and human environments
- Empower individuals to adopt conservation-minded lifestyles
- Emphasize first-hand experiences on the refuge

Strategies Applied to Achieve Objective:

Maintain existing interpretive facilities, including signs, exhibits, overlooks, and kiosks.

Annually, provide interpretive training for volunteer naturalists and participating refuge staff and partners.

By 2018, develop a partnership with the National Association for Interpretation to train refuge staff and long-term volunteers as Certified Interpretive Trainers and/or Certified Interpretive Guides.

Develop and publish an annual calendar of refuge presentations, special programs, and events. This will include volunteers and guest speakers who conduct a variety of interpretive programs on topics that support refuge messages and themes.

Partner with the Tribes to provide interpretive programs at the refuge that focus on Native Americans' traditional uses of the refuge and surrounding areas; uses of native fish, wildlife, and plants; and other indigenous knowledge.

Every 10 years, partner with Certified Interpretive Trainer(s) to conduct an audit or review of the refuge's interpretive programs to measure adherence to the Interpretive Process Model (Larsen 2003).

Rationale: Interpretation is a communication method whereby visitors and program participants forge emotional and intellectual connections between their own interests and the significance of refuge resources, and management of the refuge and the Refuge System. Interpretation differs from formal education in that participants are self-motivated, have a choice as to whether or not to participate, and are not part of a formal class seeking an educational objective. The refuge currently documents 90,000 annual visitors, only 4,000 of whom participate in formal education programs. Most of the remaining visitors come in small groups, with their families, or alone. Interpretation is a key method to connect the public with the primary messages of the refuge.

Objective 12.3 Provide opportunities for youth to participate in high-quality waterfowl hunting on the Riverboat Unit of the refuge

Waterfowl hunting on the Riverboat Unit should:

- Place a priority on safety (hunters are spaced appropriately, spatial separation exists between hunt areas and areas open to other recreational use, law enforcement presence is adequate, etc.)
- Include clear and concise regulations that are readily available
- Pose minimal conflict with wildlife and habitat objectives
- Pose minimal conflict with other priority public use activities
- Pose minimal conflict with neighboring lands
- Promote stewardship and conservation
- Provide youth with quality hunting experiences that include hunter education and mentorships in coordination with ODFW
- Promote understanding and appreciation of natural resources
- Provide reliable/reasonable opportunity to experience wildlife
- Use accessible facilities that blend into the landscape

Strategies Applied to Achieve Objective:

By 2015, complete all requirements to open the Riverboat Unit of the refuge to waterfowl hunting for youth.

Work closely with ODFW, local sporting organizations, and local hunters to develop a youth waterfowl hunt plan that includes hunter safety and mentorships.

By 2016, construct and maintain two to five hunting blinds and associated access trails on the Riverboat Unit. Manage use through a reservation and/or lottery system.

Explore the potential for local sporting organizations to provide volunteers, funding, and other resources needed to operate the youth hunting program, and maintain and repair associated facilities.

Rationale: Opportunities to hunt in the greater Portland area are increasingly scarce due to an ever-growing population, urbanization, and a relative lack of public lands open to these uses. Hunting (both for and against) was the subject of more letters and e-mails received during scoping for the CCP than any other topic. In particular, the community has expressed a very strong interest in sharing hunting traditions with youth.

Opening the refuge to waterfowl hunting will provide youth an opportunity to hunt in proximity to the urban area, in uncrowded and in relatively natural environments. In addition, youth hunts will reinforce ODFW programs that expose young people to hunting heritage, education, and mentorships. Refuge

hunting opportunities will be consistent with state hunting regulations, and with management plans for applicable game species and the PFC’s plans for cackling Canada geese (PFC 1999) and dusky Canada geese (PFC 2008).

Objective 12.4 Provide opportunities for high-quality fishing in the Tualatin River

Fishing opportunities in the Tualatin River should:

- Include clear and concise regulations that are readily available
- Pose minimal conflict with wildlife and habitat objectives
- Pose minimal conflict with other “big six” priority public uses
- Pose minimal conflict with neighboring lands
- Promote stewardship and conservation
- Focus on youth, families, and disabled persons
- Promote understanding and appreciation of natural resources
- Provide reliable and reasonable opportunities to experience wildlife
- Use the existing River Overlook on the Atfálat’i Unit of the refuge

Strategies Applied to Achieve Objective:

By 2016, complete all requirements to open the refuge to fishing on the Atfálat’i Unit.

Work closely with ODFW, local sporting organizations, and local anglers to develop a fishing plan.

Explore the desirability of user fees to help operate the fishing program, and maintain and repair associated facilities.

Explore the potential for local sporting organizations to provide volunteers, funding, and other resources needed to operate the fishing program, and maintain and repair associated facilities in lieu of or to offset user fees.

By 2017, offer at least one special fishing event annually on the refuge and/or elsewhere in the local community. This could be a Take Me Fishing event, could coincide with Oregon’s free fishing day(s) or National Fishing and Boating Week, and/or could be a separate local event at an area such as Henry Hagg Lake.

Work with partners to support and/or promote other fishing opportunities that are not on but near the refuge and/or within the Tualatin River watershed.

Rationale: Fishing opportunities on the Tualatin River, especially for families and disabled persons, are scarce. Opening the refuge to fishing will provide the public an opportunity to fish in proximity to the urban area, in an uncrowded and natural environment, and at a reasonable cost. Special emphasis will be placed on family-oriented and accessible fishing opportunities in order to introduce fishing to urban audiences who may otherwise not regularly experience this high-priority wildlife-dependent activity.

As part of an earlier planning and evaluation effort, fishing was determined compatible on the Atfálat’i Unit (USFWS 2003a). Refuge fishing opportunities will be consistent with state fishing regulations.

Objective 12.5 Explore opportunities to offer high-quality waterfowl hunting at the Wapato Lake Unit

As land acquisition progresses and habitat restoration is completed on the Wapato Lake Unit, explore opportunities to offer high-quality waterfowl hunting that:

- Place a priority on safety (hunters are spaced appropriately, spatial separation exists between hunt areas and areas open to other recreational use, law enforcement presence is adequate, etc.)
- Include clear and concise regulations that are readily available

<ul style="list-style-type: none"> • Pose minimal conflict with wildlife and habitat objectives • Pose minimal conflict with other priority public use activities • Pose minimal conflict with neighboring lands • Promote stewardship and conservation • Provide the public with quality hunting experiences that include hunter education and mentorship in coordination with ODFW • Promote understanding and appreciation of natural resources • Provide reliable/reasonable opportunity to experience wildlife • Use accessible facilities that blend into the landscape
Strategies Applied to Achieve Objective:
Concurrent with habitat restoration research and planning (see Objective 8.2), explore the feasibility of providing safe parking and access to hunting facilities, such as blinds and associated trails.
If hunting is determined feasible, complete all requirements to open the Wapato Lake Unit of the refuge to waterfowl hunting within 2 years after restoration planning is completed.
Work closely with ODFW, local sporting organizations, and local hunters to develop a waterfowl hunt plan.
Concurrent with restoration, construct hunting blinds and associated access trails on the Wapato Lake Unit. Implement and maintain a hunting program. Manage use through a reservation and/or lottery system.
Explore the desirability of user fees to help operate the hunting program, and maintain and repair associated facilities.
Explore the potential for local sporting organizations to provide volunteers, funding, and other resources needed to operate the hunting program, and maintain and repair associated facilities in lieu of or to offset user fees.
<p>Rationale: Opportunities to hunt in the greater Portland area are increasingly scarce due to an ever-growing population, urbanization, and a relative lack of public lands open to these uses. Hunting was the subject of more letters and e-mails received (both for and against) during scoping for the CCP than any other topic.</p> <p>Opening the refuge to waterfowl hunting will provide the public an opportunity to hunt in proximity to the urban area, in uncrowded and relatively natural environments, and at a reasonable cost. The habitat and wildlife objectives for Wapato Lake Unit are very likely to support quality waterfowl hunts. Refuge hunting opportunities will be consistent with state hunting regulations, and with management plans for applicable game species and the PFC’s plans for cackling Canada geese (PFC 1999) and dusky Canada geese (PFC 2008).</p>

Goal 13: Build a broad-based natural resource conservation constituency with a focus on urban audiences to create a conservation ethic within urban communities; increase relevance of habitat conservation, wildlife heritage, and the Refuge System in the eyes of urban citizens; and instill a sense of empowerment for urban communities to work together to actively support conservation, in both local and global settings.

Objective 13.1 Serve as a gathering place and clearinghouse for natural resource conservation–related information and resources to be shared among community organizations, agencies, educators, businesses, urban planners and builders, and other stakeholders
Serve as a gathering place and clearinghouse for natural resource conservation–related information and resources to be shared among community organizations, agencies, educators, businesses, urban planners

<p>and builders, and other stakeholders that:</p> <ul style="list-style-type: none"> • Provides an information exchange location for conservation partner resources as well as Refuge System information • Encourages a collaborative approach to information sharing • Is accurate, current, scientific, credible, and responsive to public requests and needs
<p>Strategies Applied to Achieve Objective:</p>
<p>Develop a guide to sustainable land management and construction practices employed by the refuge, and share with interested partners such as urban planners, developers, and individuals.</p>
<p>Develop a self-guided walking tour of the refuge’s sustainability features. This may include leaflets, exhibits, and/or technology-based information such as podcasts and QR codes.</p>
<p>Develop a reference library of natural resource/conservation education curricula, techniques, and materials. Provide access to formal and informal educators, parents, schools, and youth clubs.</p>
<p>Provide a resource library of land conservation incentives, and cost-sharing and financial assistance opportunities through organizations such as UFSWS Partners for Fish and Wildlife; Natural Resources Conservation Service; ODFW; Oregon Watersheds Enhancement Board; soil and water conservation districts; and watershed councils.</p>
<p>Engage refuge staff and Friends of the Refuge leadership in urban land use and open space planning in communities surrounding the refuge to encourage development that favors wildlife corridors, watershed protection, and high-quality nature-based recreation.</p>
<p>Provide technical assistance and/or subject matter experts to local communities for both wildlife and habitat restoration and management, and nature-based recreation and education.</p>
<p>Host one open house per year that highlights urban refuge-related conservation challenges, progress, opportunities, research, and initiatives.</p>
<p>In cooperation with Intertwine, use the refuge’s Wildlife Center to host and facilitate dialogue regarding conservation-related urban planning efforts.</p>
<p>Establish a conservation leadership program that encourages urban youth aged 18 to 25 to contribute to community conservation needs.</p>
<p>In cooperation with the Service Natural Resources Program Center’s Branch of Social Science, collect scientific literature, research, and materials supporting social values of connecting people with nature. Provide this information to partners and the public.</p>
<p>Rationale: As an urban refuge, Tualatin River National Wildlife Refuge can be a catalyst for building a natural resource conservation constituency among urban dwellers. The refuge is strategically located near more than 2 million people in the Portland-Salem metropolitan area and is accessible to countless local and regional jurisdictions, schools, agencies, nonprofit organizations, and commercial organizations. Conservation information is plentiful, but there are few places where information is centrally accessible. While the refuge cannot provide comprehensive conservation information, the refuge can partner with entities such as the Intertwine Alliance (www.theintertwine.org), ODFW, USFWS Partners for Wildlife Program, and others to leverage collective resources. In addition, the refuge can serve as an example of wildlife habitat restoration and sound land management techniques, as well as high-quality nature-based recreation and education. The USFWS “Conserving the Future” vision document (USFWS 2011c) states that “As leaders, partners, and role models in conservation efforts, we can seek to inspire others to work with us”</p>

Objective 13.2 Provide urban people tangible opportunities to experience nature and actively participate in the work of conservation

Provide urban people tangible opportunities to experience nature and actively participate in the work of conservation in a way that:

- Appeals to and reflects the diverse communities and people of the Portland-Salem metropolitan area. (Diversity may be measured in economic, educational, cultural, ethnic, and language terms)
- Builds comfort for those unfamiliar with or lacking experience in nature
- Focuses on urban citizens, with an emphasis on families and children
- Incorporates standards of excellence for urban refuges as defined in recommendation 13 of the USFWS “Conserving the Future” vision document (USFWS 2011c)
- Uses the refuge’s land base to connect people with nature

Strategies Applied to Achieve Objective:

Incorporate objectives and strategies for public activities as defined for Goals 10, 11, and 12.

Become a partner in national and regional outreach organizations such as Children in Nature Network, Nature Rocks, Intertwine Alliance, and other similar groups.

Hire urban youth (ages 18-25) through direct hires or through partnerships with organizations such as Northwest Youth Corps, Confluence Environmental Center, and Youth Conservation Corps of Oregon. Youth would participate in the work of habitat conservation on the refuge and in the community.

By researching literature and relevant publications, identify barriers to connecting the Portland-Salem metropolitan area’s urban population with nature. Use results to adapt refuge outreach, education, and interpretation programs as appropriate.

Use the refuge’s nature explore area (see Objective 11.1) to promote development of similar play areas in urban communities.

Develop a transportation outreach strategy for letting urban audiences know how to access the refuge using existing and future planned infrastructure (bus stop, bike lanes, and regional trail systems).

Rationale: Many organizations are recognizing an increasing disconnect between people (especially children) and the natural world. In addition, our society is more ethnically and socially diverse and increasingly more urban, with 80% of Americans living in urban or suburban areas. Nature therefore seems to be, or is, farther away from the majority of Americans than ever before. As urban dwellers have competing priorities, technology is replacing place-based opportunities, and natural places may be harder to access, people have fewer experiences in nature (USFWS 2011c). The Oregon Parks and Recreation Department (OPRD) recognizes several demographic and social changes, including fewer youth learning outdoor skills, a (lack of) physical activity crisis, and an increasingly diverse Oregon population (OPRD 2008). These types of changes have led to an increased disconnect between people and the natural world, to the detriment of physical and mental health, as well as decreasing understanding, awareness, and support of conservation efforts. It is critical to provide nature-based facilities and programs to provide opportunities for diverse urban publics to reconnect with their natural environment, for the benefit of both wildlife and people. Key to the effort is providing nature-based experiences starting in childhood to prepare youth with a foundation for facing future environmental challenges (Chawla 1988; Palmberg and Kuru 2000).

Objective 13.3 Share how the conservation of natural resources is relevant to urban communities

Share how the conservation of natural resources is relevant to urban communities in a way that:

- Builds support for conservation of the refuge and other natural spaces
- Reaches a demographic that mirrors the diversity of the Portland-Salem metropolitan area
- Promotes dialogue and partnerships to further identify connections between the value of the

<p>natural world and the well-being of people</p> <ul style="list-style-type: none"> Increases environmental literacy of citizens (see Rationale for definition of environmental literacy)
<p>Strategies Applied to Achieve Objective:</p>
<p>Complete an economic benefits study demonstrating the refuge’s economic contribution to local community, and share with local jurisdictions, tourism organizations, city planners, and community leaders.</p>
<p>Partner with local health care providers and organizations to promote the value of nature-based activities in support of mental and physical health for community members.</p>
<p>Identify and/or develop projects in and near the refuge, such as a water quality monitoring station or bioswale, to measure and demonstrate the value of natural systems to improving watershed health.</p>
<p>Develop outreach and interpretive materials to address landscape-level conservation issues/challenges that affect habitats and wildlife, as well as agriculture areas and communities. Examples of topics may include: the value of pollinators for native landscapes and for agricultural crops and urban gardens; the threats of non-native and invasive species; the ever-increasing interaction with wildlife in urban neighborhoods; and the effect of climate change.</p>
<p>Seek partner(s) to develop traveling exhibit and/or outreach materials demonstrating the value of natural spaces for improved mental and physical health. Display at local libraries, museums, schools, hospitals, other urban refuges or natural areas, and other urban community centers.</p>
<p>Rationale: Increasing the relevance of natural systems to urban people will build increased awareness of and support for conservation and, therefore, human well-being. The National Park Service (NPS), through its “Healthy Parks Healthy People US” strategic plan states that “human health is dependent upon the health of all species and the planet we share” (NPS 2011). Even more traditional nonprofit organizations such as The Nature Conservancy and Trust for Public Lands recognize the need for an increasing urban focus to stay viable in the minds of citizens (Grist.org 2012; Trust for Public Lands 2003). The Nature Conservancy’s chief scientist is quoted as saying “Conservation is facing a crisis of irrelevance—it is an enterprise that is not urgent to most people.... If conservation is to build the support it needs, it must energize young urban dwellers, who now make up most of the world. The best way to get city people to care about conservation is to do conservation where they live, so that nature is seen as relevant and connected to modern life” (Grist.org 2012). Also critical to gaining this support is an increased need for people to understand the interrelationship between environment, society, and economy. In 2009, the State of Oregon passed into law the “No Oregon Child Left Inside Act” (HB2544), which created a task force that, in 2010, defined environmental literacy as “an individual’s understanding, skills and motivation to make responsible decisions that consider his or her relationships to natural systems, communities and future generations” (Oregon Environmental Literacy Task Force 2010). Through the strategies listed above, the refuge can increase relevance to people’s everyday lives through their food sources, water sources, and personal health, as well as increase environmental literacy of citizens to behave in a way that contributes to conservation.</p>

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