Environmental Assessment of Williamson River Restoration – Phase 1 on Klamath Marsh National Wildlife Refuge

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CHAPTER 1 - INTRODUCTION

1.1 Background

The 43,737-acre Klamath Marsh National Wildlife Refuge (KMNWR or the Refuge) is one of six refuges within the Klamath Basin National Wildlife Refuge Complex (Complex) located in south central Oregon and northern California (Figure 1). KMNWR is located on the eastern slope of the Cascades, approximately 50 miles north of Klamath Falls, OR, and 23 miles south of Chemult, OR. It is bordered to the east by the Winema-Fremont National Forest and to the west by privately owned rangelands used for spring, summer and fall cattle grazing. KMNWR was established in 1958 when approximately 16,400 acres were purchased with Federal Duck Stamp Funds. Additional lands were acquired in subsequent years, bringing the Refuge to its current acreage and interest boundary. Originally designated as the *Klamath Forest National Wildlife Refuge*, the Refuge was renamed because virtually all of the historic Klamath Marsh now lies within the Refuge boundary. The entire Refuge lies within the lands that made up the former historic Klamath Reservation. The Klamath Tribes, comprised of the Klamath and Modoc Tribes and the Yahooskin Band of Snake Indians, utilize Refuge lands to exercise treaty subsistence hunting, fishing, and gathering rights.

Like many western valleys, early farmers and ranchers at Klamath Marsh drained wetlands to facilitate haying and livestock grazing during the spring and summer months. In the early 1900s, the Williamson River was removed from its natural morphology and diverted into multiple ditches and levee systems. These canal and levee systems have lowered the local water surface elevations of the Williamson River and affiliated groundwater tables, thus reducing marsh water storage and the extent of areas that are seasonally and permanently flooded. These alterations have likely affected many native species, including redband trout, Klamath largescale sucker, Miller Lake lamprey and wetland/riparian-dependent bird and amphibian species. Water control structures and ditch diversions have directly affected aquatic organisms such as trout and lamprey by blocking migration pathways, altering natural river flows and modifying the river channel morphology.

Current marsh habitat provides important nesting, feeding and resting habitat for waterfowl, secretive marsh birds and aquatic mammals and the surrounding wet meadows and uplands are attractive nesting and feeding areas for sandhill cranes, shorebirds, songbirds and raptors.
The adjacent ponderosa pine forests also support diverse wildlife, including great gray owl, northern goshawk, mule deer and Rocky Mountain elk. KMNWR protects one of the largest and most pristine high-elevation marshes in the Intermountain West, comprising a contiguous block of 35,000 wetland acres. The remote and diverse landscape provides important habitat for over 250 species of resident wildlife and migratory birds on the Pacific Flyway. Situated in the headwaters of the Upper Klamath Watershed, KMNWR wetlands also play a key role in affecting the water quality and quantity of the Upper Klamath Basin by attenuating water flows and modifying water chemistry.

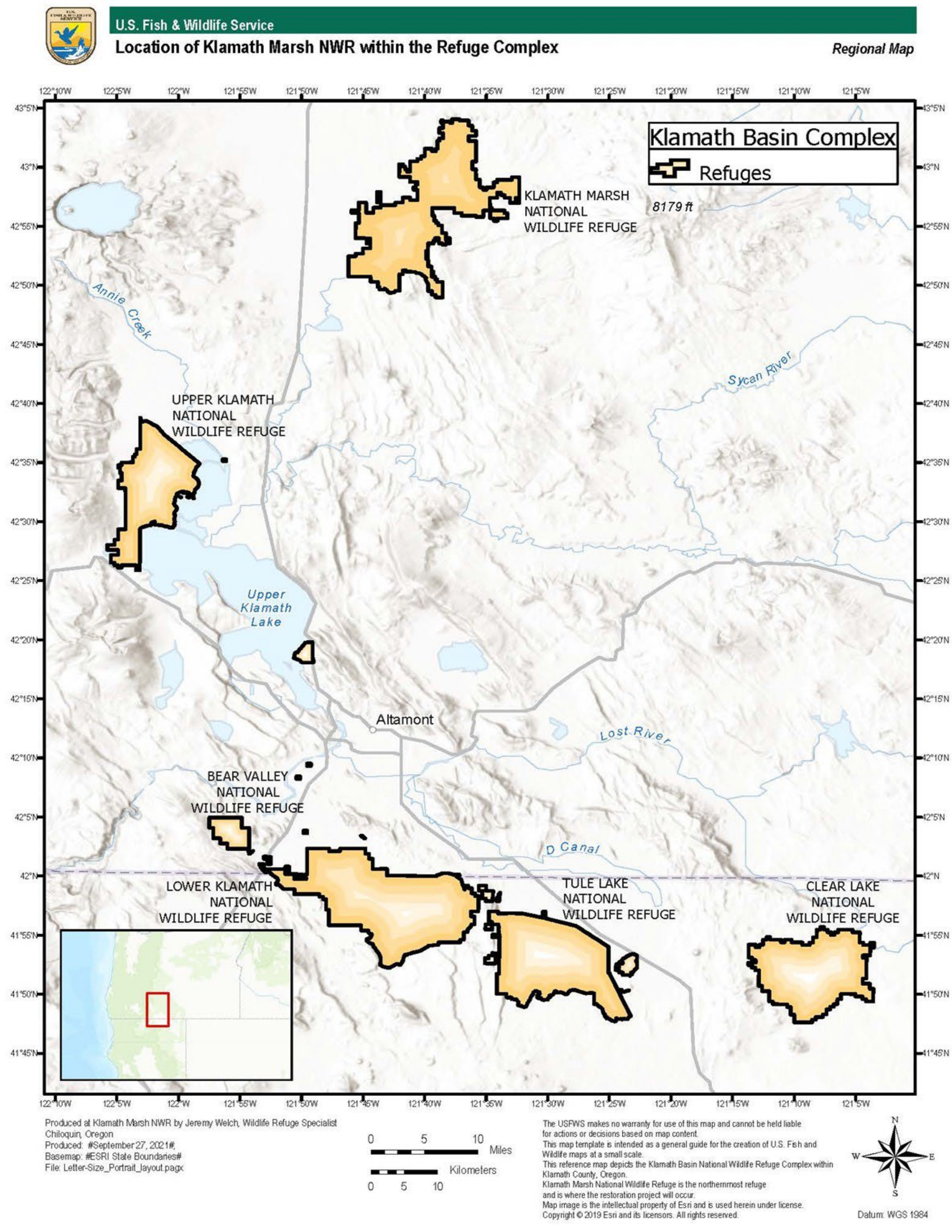

Figure 1. Klamath Marsh National Wildlife Refuge Location in the Klamath National Wildlife Refuge Complex

KMNWR is part of the National Wildlife Refuge System (NWRS), a system of 568 refuges including over 95 million acres. The mission of the NWRS, as outlined by the National Wildlife Refuge System Administration Act (NWRSAA), as amended by the National Wildlife Refuge System Improvement Act (16 U.S.C. 668dd et seq.), is:

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

The NWRS goals include the following:

a. Conserve a diversity of fish, wildlife and plants and their habitats, including species that are endangered or threatened with becoming endangered.

b. Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that are strategically distributed and managed to meet important life history needs of these species across their ranges.

c. Conserve those ecosystems; plant communities; wetlands of national or international significance; and landscapes and seascapes that are unique, rare, declining or underrepresented in existing protection efforts.

d. Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation and photography and environmental education and interpretation).

e. Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife and plants and their habitats.

1.2 Proposed Action

The U.S. Fish and Wildlife Service (USFWS or the Service) proposes to restore the Williamson River channel, side channels and hydrology (surface and subsurface) within the Project Area. The Project would reconnect the river to adjacent wetlands and riparian habitats (Figure 2). The Project would include channel reconstruction, irrigation infrastructure (control structures, weirs, bridges) removal and flow monitoring station replacement. The Service would seek to restore the Williamson River downstream of the current project to where it enters Klamath Marsh in future project phases that are implemented after the monitoring results of the current project are available.

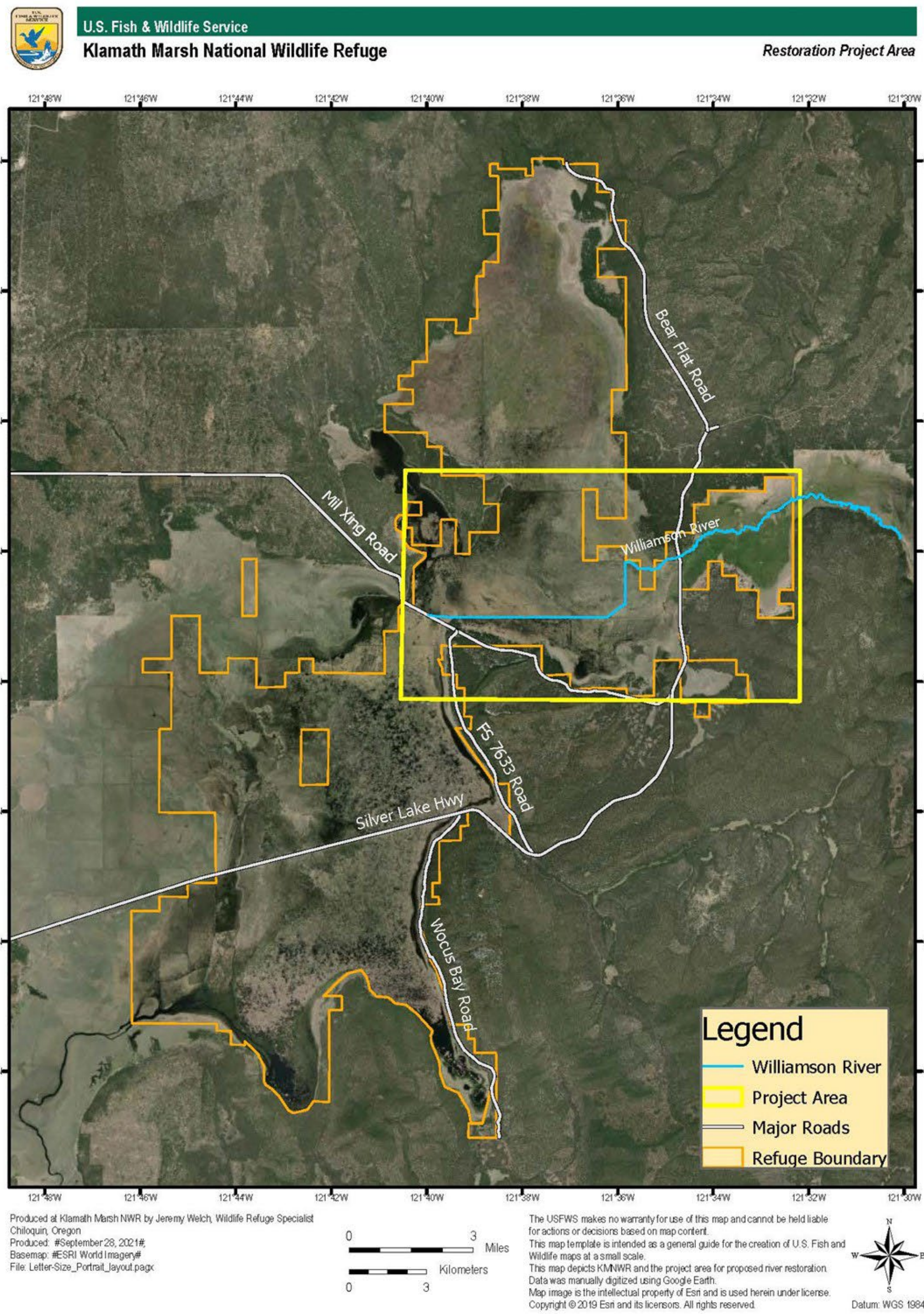

Figure 2. Project Area in the Klamath Marsh National Wildlife Refuge

1.3 Purpose and Need for Action

Prior to Refuge establishment, the Williamson River was channelized and diverted for the irrigation of lands for livestock grazing and hay production. Construction of levees, ditches and water control structures allowed for the draining of vast marshes and the redirection of the waters of the Williamson River to bypass the floodplain via canals. As needed for irrigation, waters within this canal system were blocked to allow for diversion of irrigation water to specific fields. Since the Refuge acquired these lands in 1987, the waters have been managed using the existing infrastructure of ditches and water control structures.

These canal and levee systems have lowered the local water surface elevations of the Williamson River and affiliated groundwater tables, thus reducing marsh water storage and the extent of areas that are seasonally and permanently flooded.

The canal systems and water control structures also block fish passage between Klamath Marsh and the Upper Williamson River. These areas will divert fish into fields and trap them during periods of irrigation. In addition, groundwater movement is compromised by existing infrastructure. Currently, artificial diversion of water is required to maintain wetland habitats, and because of the depth and straightness of the ditches, water tends to move downstream much faster than it historically occurred, draining thousands of acres of diverse wetlands.

Additionally, marsh hydrology is controlled by the management of water control structures, incised drains and split flows[1]. Because overbank flow during flood events is prevented by approximately 20 miles of levees, nutrients from upstream are not distributed over the floodplain. The linear drains that extend in stretches of 5 miles prevent natural processes of sediment deposition that occur in natural meandering channels.

As such, the existing irrigation infrastructure limits the hydrology of the floodplain. The purpose of the proposed restoration project (Alternative B, discussed in Chapter 2) is to improve functionality of these systems, enabling the Refuge to better support the vegetation and wildlife communities for which it was established. The proposed action will achieve this by:

a. Restoring the historical hydrology of KMNWR in the Project Area to increase both the frequency and duration of floodplain inundation from bankfull overflow, thereby reconnecting riverine, wetland and riparian habitat complexes within the floodplain.
b. Improving habitats for resident fish and wildlife and migratory species, with an emphasis on listed and sensitive species, such as yellow rails, Oregon spotted frog, Miller Lake lamprey, redband trout and sandhill cranes.
c. Removing barriers to fish passage.

More details on the restoration actions of the proposed action can be found in Chapter 2 – Alternatives.

1 Split flows refer to smaller, secondary ditches that branch off from larger, main ditches.

1.4 Previous Environmental Documents

Restoration of the Williamson River has been proposed and evaluated by numerous groups since 1999 and described in various documents, including the Klamath Marsh National Wildlife Refuge Wildlife and Habitat Review (USFWS 2004), the Upper Williamson River Watershed Assessment (Evans et al. 2005) and the Klamath Marsh National Wildlife Refuge Final Comprehensive Conservation Plan and Environmental Assessment (Final CCP; USFWS 2010). The above documents all provided the following restoration recommendations for Klamath Marsh: (1) restore connectivity of the stream channel and floodplains, (2) restore effective geomorphic processes in the stream channel and 3) restore migratory pathways for native fish.

The Final CCP was completed in 2010 under the NWRSAA, as amended. The CCP emphasizes the need to preserve, restore and enhance the natural hydrology and biological integrity of Klamath Marsh and associated uplands to provide habitat for migratory birds and other indigenous wildlife. More specifically, Goal 2 of the CCP (Riverine and Spring Riparian Habitats) seeks to "Restore the historic form and function of riverine and riparian systems to benefit native fish and wildlife, including redband trout, Oregon spotted frog, and migratory birds" (USFWS 2010). The CCP also directs that an environmental assessment (EA) be developed for restoring the Williamson River and associated floodplain riparian, wetland and sedge meadow areas. This EA provides an analysis of potential impacts of the first phase of the proposed Williamson River Restoration Project on resources within and surrounding KMNWR.

1.5 Public Scoping and Issue Identification

Public scoping for the KMNWR CCP was completed between December 2006 and March 2007. Several techniques were used to present an overview of the Refuge draft CCP and planning process as well as collect public comments. These techniques included hosting public scoping meetings as an open forum for public feedback; meeting with interested parties, local groups, resource agencies and Klamath Tribes; and periodically sending information letters to the public. A summary of the scoping comments received during this period is included in Appendix D of the Final CCP (USFWS 2010). The condition of the Williamson River flowing through the Refuge, the status of the Refuge's wetland hydrology, general water quality and Refuge water management practices were major issues identified in written comments and during meetings. Overall, the scoping comments expressed a desire to see the Williamson River restored to a more natural state by eliminating barriers and diversions.

Through development of the restoration planning process, the following issues concerning river and wetland restoration were identified:

- Cultural rights and resources
- Wildlife habitat and population
- Watershed and soil
- Vegetation communities
- Existing infrastructure

CHAPTER 2 – ALTERNATIVES

2.1 Alternatives Considered

This chapter describes two alternatives evaluated in this EA. Under the No Action Alternative (Alternative A), no wetland restoration construction activities would occur, and the Refuge would continue water management with existing infrastructure. The Preferred Alternative (Alternative B) would be located on the reach of the Williamson River upstream of Ball Dam and would focus on removing existing irrigation infrastructure and hydrologic modifications. These actions would allow for future restoration of the Williamson River downstream of Ball Dam, including levee removal and construction of a single channel with a braided network that connects to depressional wetlands and ponds. This future restoration phase would be informed by monitoring of the results of the current proposed action and would be covered in a separate NEPA analysis.

<u>Alternative A – Current Management (No Action)</u>

Under the No Action Alternative, Refuge staff would continue to utilize the existing infrastructure of canals, drains and water control structures to divert water to irrigate wetlands for hay production and native marsh habitats. Flooded wetland acreage would vary each year, with little to no water in most years, depending on climate conditions and senior water rights. The Refuge would continue to expend funding and manpower to maintain this infrastructure. Significant additional funds would be required in the future to upgrade diversion structures to allow for fish passage. In addition, screening will be required in the future to prevent fish from being diverted into canals and trapped during irrigation periods. The Kirk Ditch powerline would be maintained, and limited, if any riparian vegetation were planted along canals as debris from brush and trees tends to plug water control structures. A more detailed description of how water is managed via the current water control infrastructure can be found in Appendix R of the Final CCP (USFWS 2010).

<u>Alternative B – Preferred Alternative</u>

Alternative B would reconnect adjacent wetlands and riparian habitats within the Project Area by removing existing irrigation infrastructure and hydrologic modifications (Figure 3). The current infrastructure limits floodplain connectivity, alters the timing and duration of flooding and hinders volitional movement of native fish species at Klamath Marsh NWR. Land disturbance under this alternative would include temporary improvements to access roads, development of temporary staging areas, channel reconstruction, irrigation infrastructure (control structures, weirs, bridges) removal and flow monitoring station replacement (McMillen Jacobs 2022). McMillen Jacobs Associates was contracted and provided engineering services and developed and evaluated conceptual and engineering design alternatives for the restoration. Project activities would begin in summer (August/September) and last through October to allow for completion of work during the period of lower water levels and the driest conditions possible. Elements of Alternative B are discussed in the following sections.

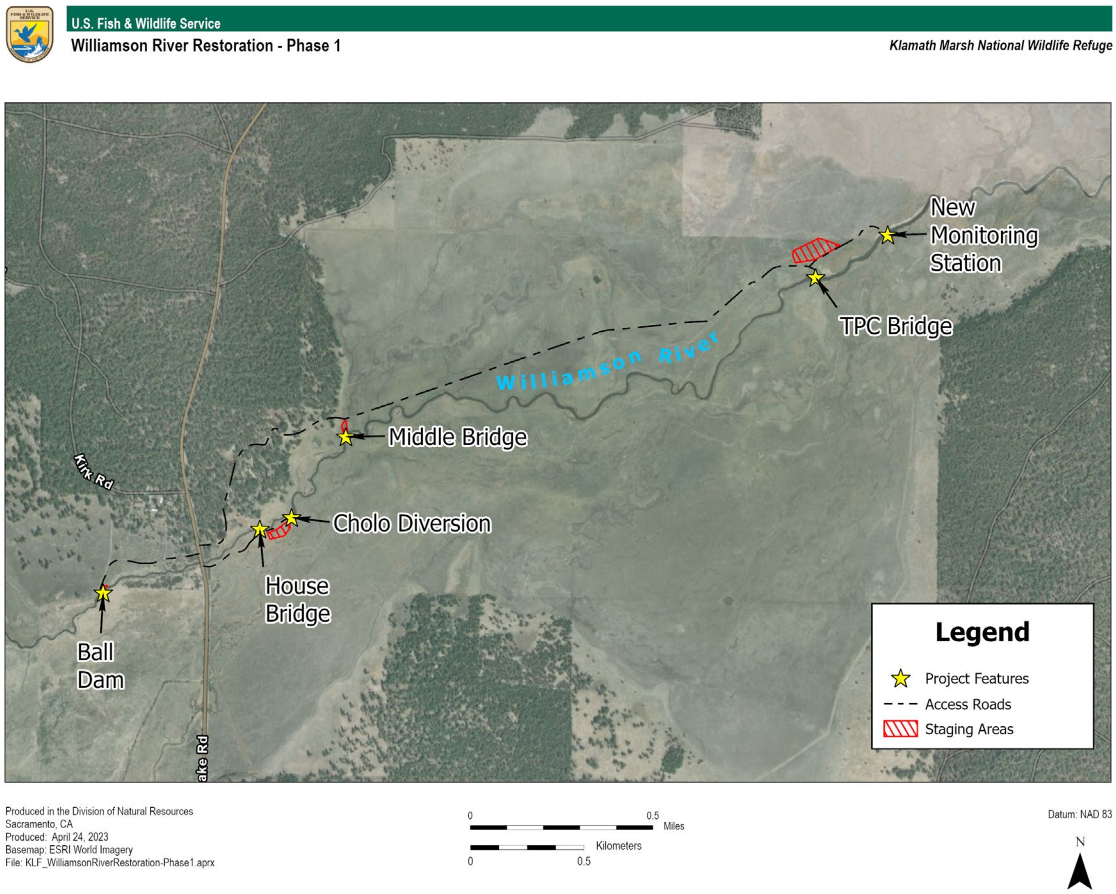

Figure 3. Project Locations, Access Roads and Staging Areas Within the Project Area

TPC Bridge

The TPC Bridge (Figure 4) is located at the far northeast extents of the Project. The bridge consists of two culverts, approximately 82 inches in diameter, made of corrugated steel and secured in place by a poured concrete bridge deck. The bridge is approximately 16 feet wide and 60 feet long. Large boulder riprap lines the downstream river-left side and some of the river-right side. Upstream, irrigation ditches connect to the left and right banks. The TPC Bridge will be demolished and hauled offsite for disposal, a process that will include removal of all miscellaneous metals, pipe culvert, concrete and fill material. Demolition will require dewatering of the Williamson River, which can be accomplished using a number of methods, including gravity diversion and pumping. Gravity diversion may be the most cost-effective option, but pumping of nuisance water that infiltrates the dewatered work area will likely be required as well. Fish rescue and salvage will be conducted in conjunction with dewatering activities. Dewatering will be the sole responsibility of the contractor.

The dewatered work area will extend far enough upstream and downstream to provide heavy equipment access to the site for placement of the roughened channel. Site grading for the roughened channel placement will include placement of compacted fill in the existing scour hole. In addition, excavation of any fine sediment material upstream of the existing bridge may be required to expose a competent subgrade. Once the initial excavation and fill operations are complete, an aggregate filter layer will be placed to prevent winnowing of fine material and to act as a filter between the subgrade and the roughened channel. The roughened channel itself will be placed on top of the filter layer and will include cobble with some boulder material interspersed with gravel and fines to create an interlocking rock mass that is moderately watertight. The channel will catch existing grade and slope upstream approximately 150 feet at a grade of approximately 2–3 percent. The upstream extents of the roughened channel will flatten out to provide a level access way for vehicles to ford the river. The cross slope along this ford accessway will not exceed 8 percent. The upstream edge of road will then taper downward in the upstream direction to catch finished channel grade at a slope no greater than 4H:1V.

The roughened channel will include a thalweg channel for fish passage at low flows. The thalweg channel will be moderately sinuous and will provide sufficient depth for upstream migrating fish across the range of design flows. The crest of the thalweg channel and the broader roughened channel will be set to induce upstream floodplain activation at the 1.5–2-year and higher flows. However, the crest will not be so high that the 10-year flow or more frequent events flood out the location of the new flow monitoring station.

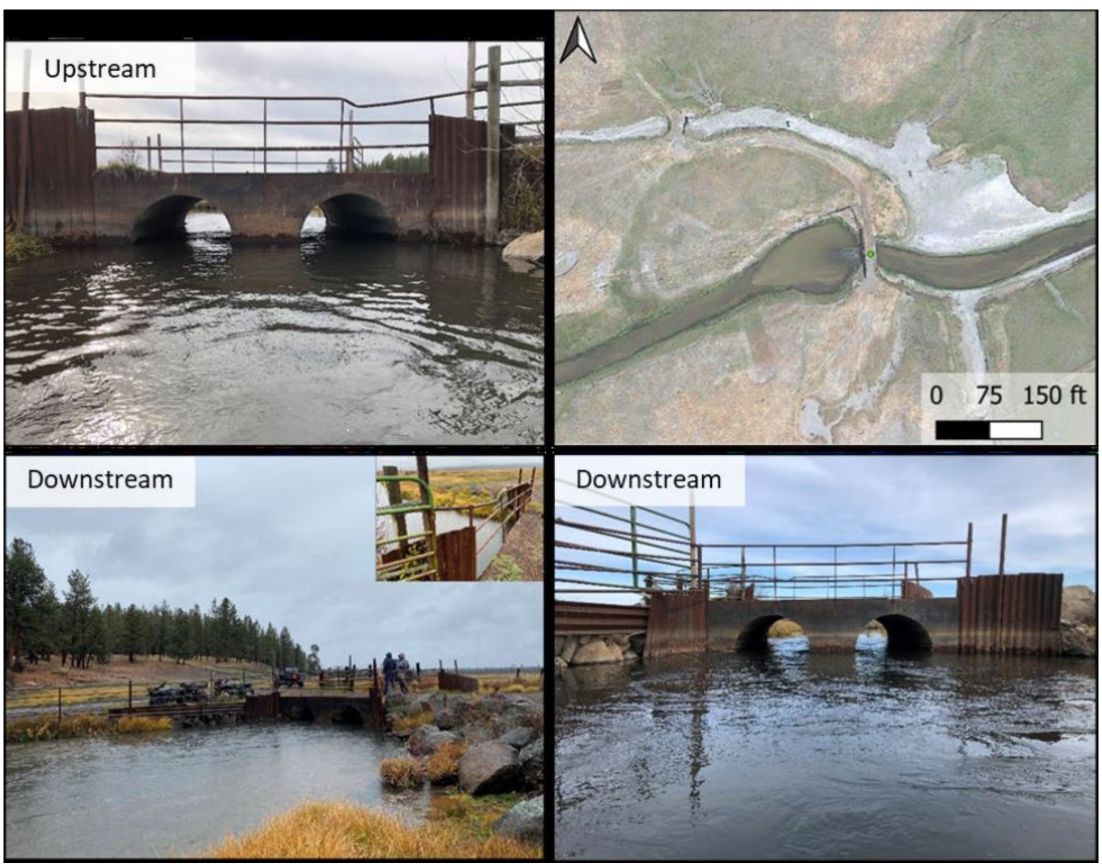

Figure 4. Photos of TPC Bridge from Upstream and Downstream and a Satellite Imagery Map

Middle Bridge

Located approximately 1.8 miles downstream of the TPC Bridge, the Middle Bridge (Figure 5) is also a culvert bridge composed of two corrugated metal pipe culverts embedded in a concrete deck structure that provides vehicular access across the Williamson River. The bridge is approximately 30 feet long and 18 feet wide. Although some cobble- to boulder-sized riprap is present on the downstream side of the bridge, the area below the culvert is scoured. The existing culverts restrict streamflow, leading to higher velocities at the culvert outlets that prohibit or greatly restrict fish passage.

The existing Middle Bridge will be demolished and hauled offsite for disposal. Because the bridge will be replaced, and due to the nature of the existing crossing, the river will need to be dewatered prior to removal. As with the TPC Bridge, dewatering can be accomplished using a number of methods, including gravity diversion and pumping. Gravity diversion may be the most cost-effective option, but pumping of nuisance water that infiltrates the dewatered work area will likely be required as well. Fish rescue and salvage will be conducted in conjunction with dewatering activities.

The dewatered work area should extend far enough upstream and downstream to provide heavy equipment access to the site for placement of a small, roughened channel to be located under the new bridge. Site grading for the roughened channel placement will include placement of compacted fill in the existing scour hole. In addition, excavation of any fine sediment material upstream of the existing bridge may be required to expose a competent subgrade. Once the initial excavation and fill operations are complete, an aggregate filter layer will be placed to prevent winnowing of fine material and to act as a filter between the subgrade and the roughened channel. The roughened channel itself will be placed on top of the filter layer and will include cobble with some boulder material interspersed with gravel and fines to create an interlocking rock mass that is moderately watertight. The channel will catch existing grade and slope upstream approximately 40 feet at a grade of approximately 2–3 percent. The roughened channel will include a thalweg channel for fish passage at low flows. The thalweg channel will be moderately sinuous and provide sufficient depth for upstream migrating fish across the range of design flows. The crest of the thalweg channel and the broader roughened channel will be set to induce upstream floodplain activation at the 1.5–2-year and higher flows.

Due to the presence of the roughened channel, providing minor grading to the approaches to the new bridge may be necessary. This grading will include fill material sufficiently compacted to limit long-term settlement. A prefabricated modular bridge will then be placed on concrete abutments situated on either side of the river. The abutments will be located such that the bankfull flow passes underneath the new bridge structure without affecting the hydraulic profile compared with upstream and downstream. In this way, the bridge will act as a “stream simulation” crossing to ensure fish passage conditions under the bridge.

Figure 5. Photos of Middle Bridge from Upstream and Downstream and a Satellite Imagery Map

Cholo Diversion

Approximately 2.1 miles downstream of the TPC Bridge, the Cholo Diversion (Figure 6) is the first major diversion of the Williamson River. The slough rejoins the Williamson River approximately 2.5 river miles downstream at the Kittredge Canal. The corrugated metal pipe is approximately 44 inches in diameter. The diversion is blocked off by the Klamath Tribes during low flow periods, typically August through March (see bottom of Figure 6).

The existing Cholo Diversion will be demolished and hauled offsite for disposal, including tarps, intake, culverts and fill material located at this site. To remove the structure, a small cofferdam will need to be placed around the diversion location. The cofferdam could be made of sandbags (e.g., super sacks) and plastic sheeting material to prevent water from entering the work area. Pumping of nuisance water that infiltrates the dewatered work area will likely still be required, as will fish rescue and salvage in the dewatered area.

The Cholo Diversion will be replaced by a single, dual-modular, horizontal flat plate fish screen and headgate structure to divert the maximum water right to the Cholo Slough. The headgate will consist of two hand-wheel actuated slide gates to manipulate flows into the slough. The fish screen will be located in-canal and will screen entrained fish into a bypass pipe that returns them safely to the river.

Figure 6. Photos of Cholo Diversion from Upstream and Downstream and a Satellite Imagery Map

House Bridge

The House Bridge (Figure 7) is located approximately 2.2 miles downstream of the TPC Bridge. The House Bridge is predominantly of timber construction with sheet pile and earthen abutments. The top deck surface of the bridge is approximately 2 to 4 inches higher than the adjacent ground surface at both ends of the bridge, suggesting poor compaction of the earthen approaches during original construction. The bridge is supported mid-span by a series of five piers, some of which are in poor condition and not vertically plumb.

The House Bridge will be demolished and hauled offsite for disposal. Removal of House Dam will take place from the overbank area using large equipment to lift the deck and piers. All miscellaneous materials will be removed in advance of large-scale demolition. The removal process will not require dewatering. However, local sediment and erosion control best management practices (BMPs) are still recommended.

Figure 7. Photos of House Bridge from Upstream and Downstream and a Satellite Imagery Map

Ball Dam

Ball Dam is a channel-spanning diversion dam on the Williamson River (Figure 8). The dam consists of a sheet pile retaining wall backfilled with earth material, a metal walkway providing access to either side of the river and slots for stoplogs to check water up for diversion. The dam includes a concrete apron for scour protection. Adjacent to the dam structure is a canal headgate and flow monitoring station. The diversion dam is capable of servicing two canals (Kenny's Canal North and South) located on either side of the river.

The current configuration of Ball Dam provides access across the river. By placing stoplogs in the dam slots, dam operators can raise the water level in the Williamson River and divert water to Kenny's Canal. Kenny's Canal consists of two canals located on either side of the Williamson River. For clarity, we will refer to the *Kenny's Canal (North)* and the *Kenny's Canal (South)*. This convention is followed in the construction drawings as well.

Work at Ball Dam will consist of demolishing the existing dam structure and appurtenant structures, including all headgates associated with Kenny's Canal (North and South). Ball Dam will be replaced by a roughened channel, with a fixed crest elevation set to check water up for diversion to either of the two canals. The area immediately upstream of the roughened channel will provide a small dead pool for sediment to accumulate over time. No bedload or suspended sediment load estimates were conducted as part of the Project. However, sediment transport through this reach of the Williamson River is expected to be minimal. A mechanically cleaned cone screen will be located upstream of the dead pool to keep fish from entering the canals. The cone screen will sit on a reinforced concrete pad at a fixed elevation below the roughened channel crest to ensure submergence on the cone at even the lowest of flows. A drop pipe will connect the cone screen to a large diameter pipe tee that connects up with two 36-inch diameter pipes that connect up with a headwall at each of the canals. The headwall will be precast and include a canal slide gate mounted to the downstream end. There will be two new headwalls and two new slide gates in total.

Figure 8. Photos of Ball Dam from Upstream and Downstream and a Satellite Imagery Map

Flow Monitoring Stations

The Cholo Slough Monitoring Station is located within Cholo Slough, approximately 200 feet downstream of the Silverlake Highway. The station includes reinforced concrete abutments on either side of the slough that constrict the flow over a raised concrete weir to force water through critical depth. The station includes a corrugated metal pipe wet well with instrumentation, telemetry and solar arrays. It is assumed that a battery energy storage system is also present at the station. Based on discussions with USFWS staff, the station is no longer functioning and will be demolished as part of the Project.

The Ball Dam monitoring station is a defunct stream gage located at the head of Ball Dam and shown in the lower right image of Figure 8. Both the flow monitoring station at Ball Dam and the larger monitoring station along Cholo Slough will be removed and hauled offsite for disposal. Neither work area will require dewatering, provided that the Cholo Slough is not watered up at the time of demolition.

The new flow monitoring station will be located roughly as shown in Figure 3. The station will consist of a side-looking velocimeter similar to other types of monitoring instruments already used by USFWS staff. The location will provide at least 10 channel widths of roughly uniform, straight channel upstream to ensure the accuracy of readings. The instrument will be mounted to a "canal" mount that places the device directly in the river flow path. The datalogger will be located in the overbank area above the 100-year flood surface and will be co-located with a small solar array and battery backup to power the instrument. A small human-machine interface is also recommended for local readout. The station will be located along river right to provide better ease of access.

Low Flow Channels

The roughened channel will include a thalweg trapezoidal channel for fish passage at low flows. The low flow channel will be placed at TPC Bridge, Middle Bridge, House Bridge, and Ball Dam. The thalweg channel will be moderately sinuous and will provide sufficient depth for upstream migrating fish across the range of design flows. The crest of the thalweg channel and the broader roughened channel will be set to induce upstream floodplain activation at the 1.5–2-year and higher flows. However, the crest will not be so high that the 10-year flow or more frequent events overtop the banks at the Silver Lake Highway Bridge located upstream. The additional volume from the low flow channel is added to the main roughened channel, allowing for the proposed upstream floodplain activation at the 1.5–2-year and higher flows.

The installation of the low flow channel will follow the site-specific roughened channel methods. The low flow channel is approximately 1–2 feet in depth with a bottom width of 2.5 feet and 2:1 sloped sides. The grade of each low flow channel will be approximately 3 percent.

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CHAPTER 3 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section describes both the affected environment and the environmental consequences of each alternative. For more information regarding the affected environment, please see the CCP/EIS (USFWS 2010).

This EA only includes the written analyses of the environmental consequences on a resource when the impacts on that resource could be more than negligible and therefore considered an "affected resource" for any alternative. Any resources that would not be more than negligibly impacted by any alternative have been dismissed from further analyses.

The following impact types are addressed in this EA:

- **Direct effects** are those that are caused by the action and occur at the same time and place. In the context of this Project, direct effects would be related to construction impacts under Alternative B.
- **Indirect effects** are those that are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. In the context of this Project, these include effects that would occur related to changes that would occur over time in the Project Area under the No Action Alternative or Alternative B.
- **Cumulative impacts** are those that result from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.

The following resource will not be affected by the proposed action and therefore is not described in the below sections.

- **Environmental Justice**: The proposed action would not disproportionately affect any minority low-income populations. Socioeconomic impacts are analyzed in more depth later in this document.

3.1 Soils

Soils within the Project Area reflect the geologic history, topography and climate that are unique to the upper Klamath Basin. No published soil survey for KMNWR exists; therefore, information for soils in the Project Area is generalized based on topographic location, draft information on soils in nearby areas (i.e., Sycan Marsh) and historical observations.

In general, most soils within the Project Area are quaternary sedimentary deposits, having some overlap with late tertiary sedimentary rock and late tertiary volcanic rock (Gannett et al. 2007). These fine- to coarse-grained sediments are deposited in Klamath Marsh by the movement of water (i.e., streams and rivers). They tend to be fine-grained sedimentary peat intermixed with thin layers of diatomaceous silts and have low to moderate permeability that results in very poor drainage and frequent, long ponding. The topography of the Project Area is extremely flat, with a slope less than 0.5 percent. Natural erosional processes and the movement of sediment through Klamath Marsh are mostly controlled by the Williamson River; however, these processes have likely been altered by the historic canal system that currently exists.

Alternative A – Current Management (No Action)

Soil resources are expected to remain the same under the No Action Alternative. Construction related to earthwork would not occur; therefore, erosion is unlikely. The current canal system is vegetated and has existed for decades; sedimentation and erosion potential will not be increased under this alternative.

Alternative B – Preferred Alternative

Land disturbance under this alternative would include (1) removal of irrigation infrastructure (control structures, weirs, bridges), (2) flow monitoring station replacement and relocation and (3) channel excavation and roughened channel placement.

Earthwork for this alternative is estimated to require disturbance of approximately 4.3 acres and the moving and redistributing of approximately 4,000 cubic yards of material. These activities may have negative impacts on soils by increasing sedimentation and erosion during and after (approximately 1 to 3 years) construction. However, mitigation measures, such as sedimentation and erosion controls (KMNWR CCP Appendix 1 of Appendix G), would be implemented to reduce these effects. Earthwork on the site would also be balanced as much as possible, and excavated materials and soils would be used to fill in locations that require increasing elevations. Additionally, limited construction activities will be executed in the first phase prior to determining the extent of following phases, minimizing the intensity of these impacts.

Positive impacts are also anticipated from these activities: the movement and redeposition of sediment in constructed channels create diverse habitat features, such as scouring in some stream reaches and depositing in others.

3.2 Water Resources

The following sections describe existing conditions and impacts from the alternatives on (1) surface water hydrology, elevation and water rights and (2) surface water quality within the Project Area.

Surface Water Hydrology, Elevation and Water Rights

Historically, the two main surface water sources for the marsh were the Williamson River and Big Springs Creek (Mayer, Wurster and Craver 2007). However, in the last 5 to 10 years, water from Big Springs Creek has flowed intermittently into the Refuge and is highly variable, with Refuge staff reporting the channel as dry in recent years. The Williamson River is the main source and forms from springheads east of the marsh, near Yamsay Mountain (USFWS 2010). It enters the Refuge from the east side on the new land acquisition that was purchased in 2020 (i.e., Kittredge Unit, TPC property).

Water surface elevations of the marsh vary seasonally and annually, influenced by climate and different hydrological stressors. Marsh levels are more responsive to wet and dry cycles that occur over a period of several years rather than individual record dry or wet years. A more detailed explanation of these fluctuations can be found in the Final CCP/EIS (USFWS 2010).

Within the Project Area, the Service holds several water rights and determined claims that establish how much water is available for wetland water management. Service water rights in the Project Area include determined Walton claims (referred to herein as *Walton claims*) and Federal reserved determined water right claims (referred to herein as *Federal reserved claims*) that are subject to ongoing adjudication, and post-code appropriative water rights for both surface water and groundwater that are not subject to the ongoing Klamath Basin Adjudication (KBA).

The Service owns nine Walton claims for water use in the KBA, with a total maximum duty of 40,426.4 acre-feet (AF). These claims are referred to as Klamath Adjudication Claims (KA) numbers 3, 9 and 301–307. Seven of these claims were filed by the Service in 1997, and two were acquired by the Service through land acquisition.

USFWS also has one Federal reserved claim in the KBA, with a maximum annual diversion volume of 59,549.4 AF. In 1975, the United States pursued a declaration of water rights in the former Klamath Indian Reservation, including the refuge lands. The court case *United States v. Adair* concluded in a 1986 settlement agreement that recognized a Federal reserved water right claim for "all Klamath Marsh lands now within the refuge" with a priority date of 1985 for all parties to the *Adair* case and 1960 for all others. As such, the Amended and Corrected Findings of Fact and Order of Determination specifies up to 59,550 AF per year (Klamath Adjudication Claim Number 300, or KA 300) for wildlife and maintenance of the Klamath Marsh ecosystem.

State-issued appropriative water rights are also held by the Service and include multiple surface water rights that represent a maximum annual duty of 54,699.0 AF and groundwater rights to pump a maximum duty of 1,730.7 AF. The appropriative water rights held by USFWS are not additive to the Walton claims or Federal reserved claims and would only be exercised if the Walton claims and Federal reserved claims are not approved in the final decree of the KBA. Details on these water rights can be found in the Water Entitlement Inventory and Assessment for Klamath Marsh NWR (WestWater Research 2021).

Waters of the Project Area are associated with one water rights certificate for water in the Williamson River that is not owned by the Service. This certificate is listed in Table 1. Currently, a private landowner on the northern edge of the Project Area has a water right and specified diversion point on the Williamson River.

A number of water rights within the larger area of the Williamson River Basin have historically impacted the ability of the Refuge to exercise water rights. The Klamath Tribes presently hold 41 claims that establish minimum flows in reaches throughout the Upper Klamath Basin. These water rights were codified in 2013 as part of the KBA. The Tribe's water rights were adjudicated with the priority date of time immemorial, senior to all other water rights.

The Tribe's water rights contain base instream flow rates that must be maintained before any junior rights may receive water. For junior rights to be curtailed, the Klamath Tribes must submit a call request, which can be made starting November 1st of each year but typically occurs the following spring. Once a request has been verified, the watermaster will verify the flow conditions and determine whether it is necessary to curtail junior water rights until the streamflows stated in the relevant Tribal claims are satisfied. Depending on the gap between the Tribal water right and the current flow of the relevant reach, the watermaster may curtail all out-of-stream uses or only down to a certain priority date. The Oregon Water Resources Department maintains a running list of priority calls on its website. More details about the Klamath Basin General Stream Adjudication and Klamath Tribes' rights to water claims can be found in the Water Entitlement Inventory and Assessment for Klamath Marsh NWR (WestWater Research 2021).

Table 1. Non-USFWS Water Rights Located Within the Project Area

Water Right Number	Claimant	Description
KA 259	Kenneth Knight/Estate of Louis Knight	For a Vested and Inchoate Water Right. Partially appurtenant to inholding lands.

Source: WestWater Research, Klamath Marsh National Wildlife Refuge: Water Entitlements Inventory (2021)

Alternative A – Current Management (No Action)

Under this alternative, the natural hydrology of the Williamson River would continue to be controlled by the present water control system. Although this infrastructure could be used to mimic the natural hydrology of the river, it is doubtful that this water management could duplicate the short-term (yearly) and long-term (decades) natural hydrologic cycles. Coupled with the senior water right calls that have been made on the Williamson River for the past 5 to 6 years, the Service cannot legally divert enough water to replicate the natural hydrology of the marsh, and the Service can therefore not fulfill wetland habitat objectives under Alternative A. This alternative would not restore the natural hydrology to the marsh, and the existing ditch system would remain in use, disconnecting the Williamson River from its historic floodplain. Therefore, maintaining the existing water control system under this alternative will have long-term negative impacts on Refuge hydrology.

No change to the existing water right or the point of diversion listed in Table 1 would occur. Boards would continue to be placed in the diversion during irrigation season, and the structure would continue to be a barrier to migratory fish movement in the Williamson River.

Alternative B – Preferred Alternative

This alternative would take important steps to restore the Williamson River and, in doing so, is likely to improve the hydrology of the Project Area and downstream of the Project Area. Both the TPC Bridge and Ball Dam are equipped with stop log structures that raise the upstream river elevation to enable diversions off the river for irrigation. This results in water pooling upstream of the structures, and decreased stream flow in the Williamson River downstream. Removing the dams and stop log structures at TPC Bridge, Middle Bridge and Ball Dam will remove the attenuation Williamson River flows upstream of these structures, changing the timing, duration and amount of flow in the river.

No impacts on water rights under this Alternative would occur. The design plans for structures that affect a private landowner's water rights include a point of diversion to ensure access to water as needed. A flow monitoring device will need to be installed by the water right owner to properly understand real-time diversion flow rates. All points of diversion include a self-cleaning fish screen to allow diversion of water but not aquatic organisms.

Surface Water Quality

Prior to management by the Service, KMNWR was historically used for cattle grazing and haying operations. Water was managed for these activities, and the marsh was not allowed to function as a perennial wetland by holding water and slowly releasing it throughout the season. Since the Service acquired the marsh in 1958, water and land management practices have shifted to a conservation focus, and few, if any, anthropogenic inputs of nutrients and/or pollutants exist within the Refuge today. The natural hydroperiod has been lengthened to some extent, and the marsh likely functions to reduce those inputs from upstream areas.

Stream temperature and sediment inputs are the major water quality concerns with the Williamson River (USFWS 2010). Warming stream temperatures threaten native fish in the river, including redband trout. Sediments can harm fish and transport phosphorus and organic matter downstream, adding to eutrophication concerns in Upper Klamath Lake.

Alternative A – Current Management (No Action)

Construction related to earthwork would not occur under this alternative; therefore, no additional sediment deposits would enter the main Williamson River channel or tributaries. Sedimentation and erosional processes related to a naturally connected riparian-river floodplain would not occur, and materials would continue to be drained out of the system. Existing water quality issues on the Refuge would persist, but no additional impacts on water quality would occur under this alternative. Therefore, water quality is expected to remain the same under the No Action Alternative.

Alternative B – Preferred Alternative

This alternative would take important steps to restore the Williamson River and, in doing so, is likely to improve the water quality of the Project Area and downstream of the Project Area by increasing minimum flows. Low minimum flows often correspond with increased stream temperatures, which can become a water quality concern, especially in warmer months. The warmer stream temperatures associated with reduced minimum flows can have a detrimental effect on aquatic and benthic biota. Short-term negative water quality effects, such as sediment and silt accumulation, are expected in the first and second years after construction. These effects will be minimized by implementation of BMPs (Final CCP Appendix 1 of Appendix G).

Removing the TPC Bridge and Ball Dam and off-channel diversions of stream flow will provide more consistent and increased downstream flow. This will likely have positive impacts on the water quality and geomorphology in the Williamson River, both within and downstream of the Project Area.

Alternative B is expected to have long-term, positive impacts on surface water quality via the movement and redeposition of material in constructed channels. Construction in the channel would create diverse habitat features via scouring banks in some stream reaches and depositing in others.

Geomorphology

Geological features surrounding the marsh were formed in the Pliocene and Pleistocene eras. Klamath Marsh is nestled in the bottom of the upper Williamson River basin, bordered to the west by the Cascade Mountain range and to the east by a series of low ridges and volcanic cones, including Sugarpine Mountain to the north, Yamsay Mountain to the east and Solomon Butte to the south (USFS 1998). Approximately 7,700 years ago, Mount Mazama erupted, forming Crater Lake and burying the marsh in up to 75 feet of volcanic ash and pumice (Cummings and Melady 2002). The eruption contributed to an enormous amount of sediment in the basin and, at one point in time, formed a lake in the South Marsh unit that covered approximately 220 square miles. It is suspected that a debris dam was naturally breached, and the lake drained to form a mosaic of perennial wetlands (Evans et al. 2005).

Historic land use practices (i.e., grazing and haying) changed natural geomorphological processes and the hydroperiod of the marsh by altering sediment transport and channel migration. The construction of containment dikes, roads and water control structures has limited and impaired the floodplain of the Williamson River. Within the Refuge, the river is now a straight channel with 90-degree bends, obstructed by various types of instream structures that block migratory fish passage by producing extreme water velocities. The river functions like an unclogged drain, removing water very quickly from a system that would naturally retain water for longer periods of time throughout an annual cycle.

Alternative A – Current Management (No Action)

Under this alternative, the natural geomorphology of the Williamson River would continue to be impaired and manipulated by the artificial water control system. Although this infrastructure could be used to mimic the natural hydrology of the river, it is doubtful that this management direction could duplicate the short-term (yearly) and long-term (decades) fluvial geomorphological cycles.

Alternative B – Preferred Alternative

This alternative will likely improve the geomorphology of the Project Area and downstream of the Project Area. Initial construction activities are likely to have short-term, negative impacts on site topography—vegetation and sediment and silt accumulation are expected in the first and second year after construction but would be minimized by BMPs identified in Appendix G of the Final CCP (USFWS 2010). After the initial construction impacts, increased minimum flows may result in greater sediment transport and a decrease in the deposition of fine sediments, which can improve conditions for benthic invertebrates by reducing this deposition onto the stream bed. Additionally, restoring sediment transport and deposition processes will bring back important geomorphologic processes that have been interrupted by the presence of the TPC Bridge, Middle Bridge and Ball Dam. Currently, sand and fine sediments accumulate upstream of the dams and bridge pilings and scour holes form at the downstream ends. This project will remove these artificial interruptions to geomorphology. Additionally, the steadier, more consistent flow that will result from dam removal may affect important surface and groundwater interactions, such as increasing recharge in downstream reaches during elevated and overbank flows.

3.3 Vegetation

General vegetation communities within the Project Area consist of perennial and seasonal wetlands, sedge-dominated wet meadows and river riparian corridors. Wetlands are composed of emergent aquatics (plants that are rooted below water and extend above the surface) and submergent/floating aquatics (plants that usually root and grow entirely underwater). Common wetland plants include hardstem bulrush (*Schoenoplectus acutus*), common cattail (*Typha latifolia*), yellow waterlily (*Nuphar lutea*, or wocus), American slough grass (*Beckmannia syzigachne*), sedges (*Carex* spp.) and rushes (*Juncus* spp.). Sedge meadows are dominated by Nebraska sedge (*Carex nebrascensis*), mountain rush (*Juncus balticus*) and Northwest Territory sedge (*Carex utriculata*) and mostly occur at the edges of emergent wetlands. Dominant plants found along river riparian corridors include Geyer's willow (*Salix geyeriana*), mountain alder (*Alnus alnobetula*), Woods' rose (*Rosa woodsii*), snowberry (*Symphoricarpos* spp.), wild mint (*Mentha arvensis*) and silverweed (*Potentilla anserina*). Various forbs and grasses are found intermixed within these communities, and a listing of plant species currently known to occur on the Refuge can be found in the Final CCP under Appendix J (USFWS 2010).

Historic conditions regarding vegetation were first described by Lieutenant Henry L. Abbot in 1855 surveys. He described Klamath Marsh as a "strip of half-submerged land about 12 miles long and 7 miles wide covered with clumps of tule, and other aquatic plants separated by small sheets of water" (Abbot 1855). In 1902, Coville estimated 10,000 acres of yellow waterlily. In 1913, a Bureau of Indian Affairs report described an area 15 miles long and 3 miles wide on Klamath Marsh engulfed in water and covered with hardstem bulrush, American slough grass and yellow waterlily (Klamath Agency 1913). In 1955, the area was recorded to consist of 9,900 acres of shallow marsh and 15,000 acres of deep marsh (USFWS 1955). By 1963, the area was said to include 920 acres of open water; 8,966 acres of marsh; 4,345 acres of wet meadow (consisting of *Carex*, *Deschampsia* and *Scirpus*); and 995 acres of grassland and conifer forest with a ratio of emergent vegetation to open water of nearly 10 to 1 (O'Neil 1963). The annual Refuge narrative in 1975 indicated the vegetation was dominated by dense stands of hardstem bulrush while open water submergent vegetation was virtually nonexistent, with an estimated 10 percent of the marsh consisting of open water. History indicates that although the same types of plant communities have persisted over time (open water with wocus, bulrush, sedge, rush, willow, grasses and ponderosa pine), the extent and distribution of these community types have changed dramatically since the turn of the century (USFWS 2010).

Since 1990, management of Refuge vegetation types has primarily consisted of haying, grazing and prescribed fire. The Refuge tries to utilize existing water control infrastructure to maintain wetlands and return some of the Williamson River back to its historic channels and sloughs. Although these strategies are somewhat successful on a small scale, major shifts in the vegetation communities have occurred since the early 1900s. Factors influencing these changes are complex and involve long-term drought, disconnected floodplain hydrology, senior water rights and increased water development upstream and downstream of the Refuge (USFWS 2010).

The Project Area has a history of disturbance from previous agricultural use and changes in hydrology, and invasive and nonnative plant species occur in some isolated areas, mainly along existing levees and roads. A list of currently known invasive plants that occur within the Refuge and their proposed control methods can be found in the Final CCP under Table 3-7 (USFWS 2010).

Alternative A – Current Management (No Action)

Diversified vegetation communities that historically existed within the Project Area are now limited by altered hydrology. Without the activities in the Preferred Alternative (Alternative B) and future phases, vegetation communities would remain in a late successional state, dominated by a monoculture of emergent plants (i.e., cattail and bulrush). Perennial, open water wetlands would continue to decline and be replaced by seasonal wetlands. The distribution and size of key habitat types that exist in the Project Area would remain below the potential for wildlife use within the site. As such, the Service is unable to maintain Refuge habitat goals and objectives under this alternative.

Alternative B – Preferred Alternative

Under Alternative B, there would be some short-term temporary impacts on stream channel vegetation during channel excavation and roughening activities. The replacement of water control structures with a free-flowing river system and functioning riparian habitat in later phases will enable native fish to access upstream Williamson River reaches and move within Klamath Marsh channels, wetlands, and backwaters according to their seasonal needs. Future project phases will include restoration of native vegetation communities, which will meet the life history needs of all stages of resident wildlife and the seasonal requirements of migratory species. Any impacts on vegetation would be minimized by BMPs identified in KMNWR CCP Appendix 1 of Appendix G.

3.4 Fish and Wildlife

Over 250 species of wildlife reside, migrate through, nest, forage, hunt or loaf in Klamath Marsh. Historically, the valley bottoms of the Upper Klamath Basin were a mosaic of wetlands, shallow lakes, and freshwater springs totaling approximately 185,000 acres (USFWS 2016). These vast wetlands supported hundreds of different fish, wildlife, and plant species, including some of the greatest fall and spring concentrations of migrating waterfowl within the Pacific Flyway. Today, less than 25 percent of Klamath Basin wetlands remain intact, and most are now protected as managed wildlife areas (USFWS 2016).

A list of fish and wildlife species that are known to occur or may potentially occur on the Refuge can be found in Appendix J of the Final CCP (USFWS 2010). Refuge staff conduct monitoring of focal species when resources are available. Historical and existing fish and wildlife conditions are described in general below.

Fish

Over time, the Upper Klamath Basin formed a unique geologic history that has included alternating hydrologic connections to the Great Basin, Columbia River Plateau and the Pacific Coast. This geomorphology created a distinct fisheries community that consists of many endemic species, including individuals from fish families *Petromyzontidae* (lampreys), *Cyprinidae* (minnows), *Catostomidae* (suckers), *Salmonidae* (salmon and trout) and *Cottidae* (sculpins). Native species occurring on the Refuge include Great Basin redband trout (*Oncorhynchus mykiss gibbsi*), speckled dace (*Rhinichthys osculus*), tui chub (*Gila bicolor*), blue chub (*Gila coerulea*), Miller Lake lamprey (*Lampetra minima*) and Klamath largescale sucker (*Catostomus snyderi*). Annual fish monitoring does not occur on the Refuge, and baseline surveys are mostly conducted through state and Federal partnerships. See Appendix J-7 of the Final CCP for a complete list of fish species that are known or expected to occur in the Project Area (USFWS 2010).

Fish habitat in the Project Area is limited due to the highly altered hydrologic flow patterns and lack of connectivity of wetlands and tributaries to the Williamson River. Fish passage is blocked year-round by major water control structures, impeding seasonal migrations of redband trout, Miller Lake lamprey and Klamath largescale sucker, which are state-regulated native fish species. The shallowness and channelization of the Williamson River can result in difficult fish passage conditions in the fall and winter, when redband trout spawning migration peaks. Additionally, diversions on Ball Dam and Cholo Slough are unscreened, posing entrainment hazards for juvenile fish.

Waterfowl

KMNWR is located along the Pacific Flyway, and the region is noted for its waterfowl abundance in both fall and spring, with numbers generally ranging from one to two million birds during the peak of migration (USFWS 2010). The American Bird Conservancy has recognized KMNWR as an Important Bird Area in the state of Oregon, emphasizing the importance and need for resources to conserve the diverse wetland habitats within the Refuge.

When compared to Tule Lake and Lower Klamath NWRs, Klamath Marsh has moderately low numbers of waterfowl during migration, influenced by several factors. The Refuge is at a high elevation (approximately 4,591 feet), with freezing of marshes occurring early in the fall and ice often remaining late into the spring, limiting available waterfowl habitat. Furthermore, the existing hydrology of Klamath Marsh results in very low marsh water levels in fall. During drought years, most of the wetland habitat on the Refuge is dry by fall. Lastly, altered vegetation communities have resulted in large areas of dense emergent stands of cattail and bulrush, restricting open water use by spring and fall waterfowl arrivals (USFWS 2010).

Waterfowl use varies substantially from year to year, depending on fall and spring water conditions, Refuge habitat management practices, and disease outbreaks. The most common waterfowl species using the Refuge include northern pintail (*Anas acuta*), mallard (*Anas platyrhynchos*), American wigeon (*Anas americana*), northern shoveler (*Anas clypeata*), cinnamon teal (*Anas cyanoptera*), ruddy duck (*Oxyura jamaicensis*), gadwall (*Anas strepera*) and canvasback (*Aytha valisinera*) (Gilmer et al. 2004). Waterfowl primarily use the large contiguous emergent marshes at KMNWR for molting, breeding and resting during fall and spring migrations. Refuge staff conduct monitoring of focal species when resources are available. See Appendix J-10 of the CCP for a complete list of waterfowl species that are known or expected to occur in the Project Area (USFWS 2010).

<u>Waterbirds</u>

Nongame waterbirds are broadly grouped from several orders that include shorebirds, gulls, terns, cranes, rails, herons, grebes, egrets, loons, cormorants and ibis. Klamath Basin wetlands are considered of regional and continental significance for bird life and fall under Bird Conservation Region (BCR) 9, which mostly consists of the great basin. BCRs are developed by the North American Bird Conservation Initiative to assist with bird conservation planning at multiple scales, and they represent ecologically distinct regions in North America with similar bird communities, habitats and resource management issues (NABCI 2016). Klamath Marsh has three waterbirds of conservation concern that include the yellow rail (*Coturnicops noveboracensis*), black tern (*Chlidonias niger*) and greater sandhill crane (*Antigone canadensis*) (USFWS 2021). A complete list of waterbirds known to occur on KMNWR is listed in Appendix J-10 of the CCP (USFWS 2010).

Yellow Rail

The yellow rail is a secretive marsh bird broadly distributed in the United States and Canada, with most of its range lying east of the Rocky Mountains (Leston and Bookhout 2020). A small, disjunct population exists in the western United States with breeding habitat identified in south central Oregon and wintering areas suspected to occur along northern California coastal marshes and possibly into the central valley (Stern, Morawski and Rosenberg 1993; Shuford and Gardali 2008). Breeding habitat is associated with shallow marsh wetlands composed of dominant sedge and rush plant communities and generally contains 7–15 cm of surface water (Bookhout and Stenzel 1987; Popper and Stern 2000). Klamath Marsh is recognized as the central stronghold for breeding yellow rails due to its large, extensive acreage of suitable breeding habitat (USFWS 2010). Since 1991, various surveys have been completed on KMNWR to estimate the annual number of calling males and establish baseline trends; however, there are only 5 years of complete survey information (with only 3 that are consecutive) available for review (USFWS 2010; WYRWG 2021). See Figure 9 for a summary of complete survey years. The downward trend in calling males may be related to long-term drought in the region, exacerbated by a degraded wetland hydroperiod within Klamath Marsh.

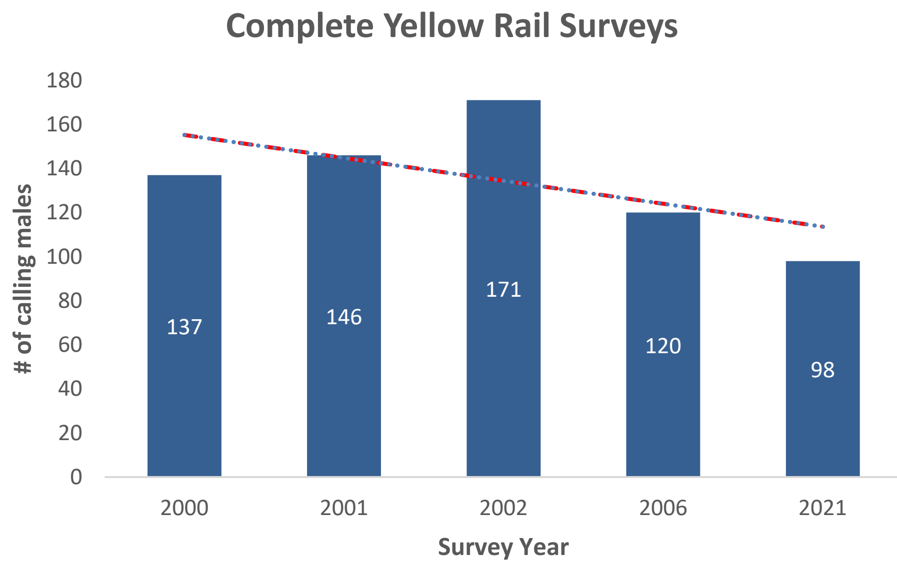

Figure 9. Summary of Klamath Marsh NWR Complete Survey Years for Yellow Rails (Calling Males)

Note: Dashed red line represents current trend and centered white numbers equal total counts for each survey year.

Black Tern

The black tern is one of the iconic marsh terns of North America. It is distinguished from other terns by its smaller size, darker plumage and affinity to freshwater marsh habitats for breeding and foraging (Heath et al. 2020). During the breeding season, this semicolonial nester can be found constructing floating nests in emergent wetland vegetation commonly associated with functioning shallow marshes (Heath et al. 2020). Social foraging is done in large flocks, with birds primarily hawking insects out of the air on breeding ranges and catching fish in productive marine waters on wintering ranges (Heath et al. 2020). In the United States, black terns are a Federally designated Category 2 Candidate Species and have experienced long-term population declines across much of their breeding range, most likely caused by a loss of wetland habitat (Heath et al. 2020; USFWS 2021).

Black terns are known to nest on the Refuge and have been documented in Big Wocus Bay, Little Wocus Bay, the Peninsula Lake and south of Silver Lake Highway as it bisects the marsh. In 1991, the Refuge observed approximately 120 black tern nests in the South Marsh Unit (USFWS 2010). In the Klamath Basin, Agency Lake and Upper Klamath Lake black tern populations were monitored from 2001–2010 by The Klamath Bird Observatory, and their results estimated an 8.4 percent population decline in adult black terns (Stephens and Rockwell 2015). Currently, no standardized survey or monitoring plan for black terns exists on KMNWR. In May of 2021, Refuge staff and volunteers observed large groups of black terns foraging at the Peninsula Lake (Welch and Hourt 2021).

Sandhill Crane

The sandhill crane is a large-bodied waterbird with an extended neck and long legs that prefers upland grasslands, wet meadows and freshwater marshes for breeding, foraging and resting habitat (Gerber et al. 2020). Across North America, the species is split into nine populations, six of which are migratory. Klamath Marsh is identified as an important breeding and migration site for the Central Valley and Pacific Flyway populations of greater sandhill cranes (USFWS 2010). From 1991–2007, Refuge biologists conducted breeding surveys in April each year, estimating the total number of paired cranes using Klamath Marsh. Ground surveys make accurate counts difficult to obtain because of dense vegetation and lack of access; therefore, estimates likely represent minimum numbers. See Figure 3-8 in the CCP for a summary of the survey results (USFWS 2010).

In April of 2021, Refuge staff conducted a complete ground survey of Klamath Marsh and documented 14 pairs and 12 individuals for an estimated total of 40 greater sandhill cranes.

Songbirds

Songbirds include a wide array of land birds, such as hummingbirds and woodpeckers, as well as the larger order of birds called passerines or "perching" birds. Passerines comprise more than half the world's species of birds, and all have a perching foot that includes three toes forward and one two backward. They range in size from wrens to ravens and include flycatchers, shrikes, vireos, crows, jays, chickadees, nuthatches, tanagers, cardinals, sparrows and finches. On Klamath Marsh, 18 songbird species have been identified as species of conservation concern by Partners in Flight for BCR 9 (USFWS 2021). An extensive number of songbirds are known to occur on KMNWR, as listed in Appendix J-10 of the CCP (USFWS 2010).

Raptors

Raptors are birds that hunt, capture and eat a carnivorous prey base using strong decurved bills and long, sharp talons. More than 26 species of raptors have been documented on Klamath Marsh and typically include vultures, hawks, falcons, owls and eagles (USFWS 2010). Migratory and resident raptors use Klamath Marsh and the adjacent Fremont-Winema National Forest for year-round nesting, hunting and resting habitat.

Specific monitoring of raptors on the Refuge has only been completed for the bald eagle (*Haliaeetus leucocephalus*), and a history of nesting and eaglet production from 1978–2008 can be found in the CCP under Figure 3-9 (USFWS 2010). Wintering bald eagles were surveyed from 1988–2009 as part of the National Midwinter Bald Eagle Survey, and data were contributed to national efforts in the lower 48 states (USFWS 2010).

In 1991, Refuge biologists and volunteers installed nine nesting platforms for great gray owl (*Strix nebulosa*), one of North America's largest owls that prefers mature conifer forests and open meadows for nesting and hunting (USFWS 2010). In 2020, one additional platform was installed in the Kittredge Management Unit (i.e., TPC Ranch, recent acquisition). All platforms were checked for nesting owls in 2020 and 2021. Refuge staff documented one platform occupied by a great horned owl (*Bubo virginianus*) in 2020 and no observations of any occupied platforms in 2021. A complete list of known raptor species occurring on KMNWR can be found in Appendix J-10 of the CCP (USFWS 2010).

Mammals

Specific inventories of mammals have not been completed on the Refuge. Most of the mammals observed at Klamath Marsh are year-round residents. Small mammals present include several species of shrews, moles, squirrels, gophers, weasels, rabbits, mice and bats. Large mammals commonly found include elk, mule deer, pronghorn antelope, badger, striped skunk, bobcat, black bear, mountain lion, wolf and coyote. In addition, muskrat, beaver and river otter are found in the aquatic habitats of the Refuge. A list of mammal species known or anticipated to occur on KMNWR is provided in Appendix J-5 of the CCP (USFWS 2010).

Reptiles and Amphibians

There are 15 species of reptiles and seven species of amphibians suspected to occur on Klamath Marsh (USFWS 2010). Survey work for reptiles and amphibians is minimal and information on the occurrence, distribution and abundance of most species is not available. Current Refuge knowledge is limited to the Oregon spotted frog (*Rana pretiosa*), a Federally threatened species listed under the Endangered Species Act (ESA) on August 28, 2014 (USFWS 2014). This species is discussed in more detail under the Threatened and Endangered Species section of this assessment. See Appendix J-8 of the CCP for a complete list of reptile and amphibian species known or likely to occur within the Refuge (USFWS 2010).

Invertebrates

Invertebrates are classified as organisms that have no backbone, and they comprise most animals existing on Earth. Examples include insects, worms, corals and jellyfish. Aquatic and terrestrial invertebrates provide a critical food source for many wildlife species on the Refuge (USFWS 2010). In combination with other food types, aquatic invertebrates are an essential part of many waterbird diets at various times of the year because they provide a balance of amino and fatty acids to help with fat and protein storage. This food source is crucial for energy production during migration, molting and egg formation. A baseline inventory of invertebrate species has not been completed on the Refuge. A brief list of known invertebrate species occupying the Refuge can be found in Appendix J-9 of the CCP (USFWS 2010).

Alternative A – Current Management (No Action)

Under the No Action Alternative, hydrologic conditions would vary under wet years (prolonged surface flooding), moderate years (short-term seasonal flooding) and dry years (no surface flooding). Effects on fish and wildlife would vary based on annual site conditions, as described in the following sections, but would not substantially differ from existing conditions.

Fish

Under Alternative A, existing fish habitat limitations would continue to occur under any year type. Fish passage would remain blocked by major water control structures all year in the Williamson River, preventing migratory movements of redband trout, lamprey and largescale suckers from accessing the headwaters of the river. Legal points of water diversion occurring throughout the Project Area would remain unscreened, or inadequately screened, posing entrainment hazards for juvenile fish. Continued use of existing water control infrastructure to manage wetland flooding would potentially subject juvenile fish to impingement and entrainment through water diversions that seasonally go dry.

Wildlife

Wildlife conditions under the No Action Alternative would be similar to existing conditions. Potential effects on wildlife would vary in wet and dry years, as described below, but would not substantially differ from existing conditions.

Wet Years

Based on current habitat diversity that occurs throughout the area, wet years may benefit a wide diversity of fish and wildlife when flooded throughout the year. Due to the disconnection of the Williamson River from the floodplain, the available habitat for the Project Area is well below its total potential in any type of year. Projected seasonal use would include the following:

- Spring – The Project Area may support limited habitat for migrating and nesting waterfowl, waterbirds, songbirds and raptors. Foraging habitat for wading birds, such as stilts, egrets and herons, would be restricted to irrigation ditches and small areas of open water existing in the Jonesy, North Kirk, South Kirk and Military Management Units. Yellow rail breeding habitat would remain limited to the same areas. Sandhill crane nesting and brood-rearing habitat would be marginal compared to historic records. Black terns are expected to continue using the Jonesy Management Unit for potential foraging and breeding habitat. Amphibians would continue to breed and forage in the Project Area where suitable habitat (i.e., water) occurs. Mammals and reptiles may use the existing upland habitat for breeding, foraging and cover.
- Summer – Nesting habitat for wetland obligate wildlife species is expected to occur within the Project Area. Yellow rails would nest and forage where surface water and vegetation requirements are met. Sandhill cranes would continue to forage and raise broods in limited numbers. Nesting black terns would be restricted to areas of open water that remain flooded throughout summer. Adult amphibians would continue to utilize available foraging habitat, and juveniles would likely start to disperse from egg mass sites. Elk may start to seek out isolated willow patches for cover during calving season. Reptiles would continue to use drier sites for forage and dispersal movements.
- Fall – High use is expected for migratory birds and ungulates. Waterfowl, waterbirds, songbirds and some raptors would use the Project Area for staging, stopover and rest. Elk may begin to enter the rut and start to form small herds. Amphibians and reptiles may begin to enter hibernacula, burrowing into belowground substrates.
- Winter – Although habitat benefits are limited for most migratory birds, resident wildlife species would remain in the Project Area. Year-long raptor use is expected to occur within the Project Area due to a high prey base of small mammals. Amphibians and reptiles would continue to use limited overwintering habitat.

Moderate Years

- Spring – The Project Area may support limited habitat for migrating and nesting waterfowl, waterbirds, songbirds and raptors. Foraging habitat for wading birds such as stilts, egrets and herons would be marginal compared to wet years. Foraging habitat for shorebirds may increase as mudflats are exposed due to less water. The extent of yellow rail breeding habitat would remain limited to the same management units. Sandhill crane nesting habitat would decrease compared to wet years, and brood-rearing habitat may increase. Black terns are expected to continue using the Jonesy Management Unit if open water is present and persistent throughout the summer. Amphibians would continue to breed and forage in the Project Area where suitable habitat (i.e., water) occurs. Mammals and reptiles may use the existing upland habitat for breeding, foraging and cover.
- Summer – Nesting habitat for wetland obligate wildlife species may be limited in moderately wet years. Yellow rails would nest and forage where surface water and vegetation requirements are met. Sandhill crane nesting habitat may be limited with less water and forage and brood-rearing habitat may increase as seasonally wet areas dry out. Nesting black terns would be limited to areas of open water that remain flooded throughout summer. Adult amphibians would continue to utilize available foraging habitat and juveniles would likely start to disperse from egg mass sites. Elk may start to seek out isolated willow patches for cover during calving season. Reptiles would continue to use drier sites for forage and dispersal movements.
- Fall – Low to moderate use is expected for migratory birds and ungulates. Staging and stopover habitat for migrating waterfowl and waterbirds would be limited to the amount of available open water. Songbird use is expected to remain high. Raptor use could decrease if available prey bases (e.g., eagles hunting ducks) are not present. Elk may begin to enter the rut and start to form migratory herds. Amphibians and reptiles may begin to enter hibernacula, burrowing into belowground substrates.
- Winter – Although habitat benefits are limited for most migratory birds, resident wildlife species would remain in the Project Area. Mammal use would occur in drier areas. Year-long raptor use is expected to occur within the Project Area due to a diverse and large prey base. Amphibians and reptiles would continue to overwinter in wet and dry areas.

Dry Years

- Spring – Limited nesting and brood-rearing would occur for waterfowl, waterbirds, songbirds and raptors across the Project Area. Shorebird use is expected to increase with availability of exposed mud flats. Yellow rail nesting and foraging habitat would be constrained by available surface water. Sandhill crane nesting habitat availability would be the lowest in this year type. Black terns may not be present if open water is lacking. Mammal and reptile use may increase, along with foraging areas for some raptor species.
- Summer – Nesting and brood-rearing habitat for wetland obligate wildlife species would be at its lowest potential. Yellow rails may abandon nesting attempts and move off the Refuge in search of suitable habitat or forego breeding altogether. Sandhill crane foraging and brood-rearing habitat would be marginal. Black terns may not be present if open water is lacking. Mammal and reptile use may increase, along with raptor foraging habitat.

- Fall – Migratory songbirds would be present. Waterfowl and waterbird habitat may not be available if there is no water in the ditches and canals. Mammal and reptile use may increase, along with foraging areas for raptors.
- Winter – In the driest years, if canals and ditches retain no water, no waterfowl and waterbird habitat would be available. Wetland obligate species would decrease due to limited or no existing habitat, and upland obligate species may increase with drier conditions.

Alternative B – Preferred Alternative

Later phases of this alternative will restore the riverine system and reconnect it to the historic floodplain, thus sustaining the water table and seasonal surface water hydrology that supports diverse wetland vegetation communities. Wetland water levels will vary in water depth as well as length of inundation, resulting in long-term beneficial effects on fish and wildlife. Short-term negative effects on fish and wildlife during construction and restoration activities (described below) may also occur, but these will be minimized by implementation of BMPs and are outweighed by the long-term beneficial effects described above.

Fish

Under Alternative B, removal of major water control structures would, in the long term, increase available wetland habitat and remove upstream barriers to historic winter migration routes for trout, lamprey and suckers. Larval and juvenile suckers are known to use a mosaic of submerged and emergent wetlands and open water for rearing, feeding and cover (USFWS 2012). During the first 5 years of the Miller Lake lamprey larval state, juveniles burrow into silty substrates and have a strong association with depositional environments like those found in perennial wetlands (ODFW 2005). Habitat for the life history stages of these species and others is expected to improve and increase with river restoration and floodplain connectivity in the long term.

Trout, suckers and lamprey would be expected to recolonize a network of streams with restored channels and flows through the Project Area after subsequent phases are completed. The quality and spatial coverage of submerged and emergent wetlands for larval and juvenile native fish species would be substantially larger than Alternative A because floodplain activation and recharge are highest in an anastomose channel system, where more water can move across a larger landscape.

Fish passage would be completely restored under Alternative B as compared to the No Action Alternative due to the removal of major water control structures. Currently, these structures create high water velocities that are not natural to the Klamath Marsh system and pose as barriers to native fish species attempting to move upstream. In addition to fish moving upstream from the Refuge, fish from the upper watershed will have access to downstream seasonal food and habitat resources within KMNWR.

Construction activities would include decommissioning major water control infrastructure, and land grading and earthwork (terraforming) within the Project Area, which would provide surface water connectivity to minimize fish stranding hazards. Soil disturbance during construction may result in silt and sediment being carried into local waters during stormwater runoff, temporarily adversely affecting water quality (e.g., pH, turbidity) and thus aquatic species.

Limiting most ground-disturbing construction to the dry season and implementation of BMPs to protect sensitive species and aquatic and riparian habitats, as detailed in Appendix 1 of the CCP (USFWS 2010), would avoid impacts on fisheries resources or minimize them to insignificant levels.

Wildlife

The diversity of habitats provided under this alternative would be tied to the natural hydrology of the Williamson River, a hydrologic cycle to which species native to KMNWR are adapted. The removal of fish barriers would provide an additional 3 miles of natural channel that will eventually be reconnected to the upper river. The diversity of vegetation and hydrology would provide for many of the year-round needs of wildlife species. Elimination of water control infrastructure would reduce the amount of disturbance to wildlife near the present access road system.

3.5 Threatened and Endangered Species

The following Federally listed species were identified in the USFWS Information for Planning and Consultation report as being potentially affected by activities in the Project Area (USFWS 2023):

- Gray Wolf (*Canis lupus*)
- North American Wolverine (*Gulo gulo luscus*)
- Yellow-billed Cuckoo (*Coccyzus americanus*)
- Oregon Spotted Frog (*Rana pretiosa*) (including designated Critical Habitat)
- Monarch Butterfly (Danau*s plexippus*)

No modern records of occurrences of the yellow-billed cuckoo or North American Wolverine in the Project Area exist. Threatened and endangered species with potential to occur in the Project Area and that could be affected by the Project are discussed in the following sections and in the ESA Section 7 consultation prepared for this project.

Gray Wolf

Gray wolf has the potential to occur in the Project Area, but no modern occurrences at KMNWR are known (USFWS 2010). Wolves could disperse throughout or near the Project Area. However, no den sites within about 1 mile of the KMNWR are known. Dispersing wolves are less vulnerable to disturbance than denning wolves and pups and are not expected to be harmed by Project activities (Vradenburg 2023).

Monarch Butterfly

Monarch butterflies are common throughout the Klamath Basin and have the potential to occur in the Project Area. However, no sources of milkweed are known in the Project Area. Adult

Monarch butterflies could fly through or near the Project Area, but eggs, caterpillars or chrysalids are not present because their critical habitat for these life stages is not present in the Project Area. Dispersing adult butterflies are less vulnerable to disturbance than other butterfly life stages and are not expected to be harmed by project activities (Vradenburg 2023).

Oregon Spotted Frog

The Oregon spotted frog was listed as threatened on August 29, 2014 (79 FR 51657 51710), and the final designation of critical habitat for the Oregon spotted frog went into effect on June 10, 2016.

Spotted frogs need diverse wetland habitats to complete their annual life cycle. They require shallow water wetlands for oviposition (egg laying), egg mass development and metamorphosis. During the summer, spotted frogs require deeper water perennial wetlands, with a mixture of emergent, submergent and floating vegetation (Corkran and Thoms 1996; Leonard et al. 1993; McAllister and Leonard 1997; Pearl 1997, 1999; all as cited in USFWS 2017). Frogs can overwinter in perennial wetlands that do not freeze to the bottom or in perennial streams (Corkran and Thoms 1996; Leonard et al. 1993; McAllister and Leonard 1997; Pearl 1997, 1999; all as cited in USFWS 2017). Preferred vegetation communities include a variety of native grasses, sedges and rushes (Corkran and Thoms 1996; Leonard et al. 1993; McAllister and Leonard 1997; Pearl 1997, 1999; all as cited in USFWS 2017).

A population of Oregon spotted frogs was first documented on the Refuge in 1994 (Drew 1995, 1996). Egg mass surveys were conducted annually from 2000–2008, although survey efforts were not consistent over the years and no annual reports were generated (USFWS 2010; see Table 3-3 and Figure 2-12). No occupied spotted frog foraging, breeding and overwintering habitat occur in the Project Area. In September 2012, 25 experimental ponds were created outside of the Project Area to evaluate different habitat restoration techniques, and they are now monitored by the United States Geological Survey. Since that time, egg masses and adult spotted frogs have been observed in the experimental ponds. Under future phases of Alternative B, design planning would account for maintained hydrologic connectivity with the experimental ponds to protect the existing population of spotted frogs.

Alternative A – Current Management (No Action)

Habitat conditions are expected to remain the same under the No Action Alternative. Available wetland and open water habitat would remain limited to ditches, canals and artificially created ponds. Existing conditions of limited habitat availability and suitability in the Project Area would continue to occur, which would affect the health, growth, reproductive success and population. These factors all potentially limit the recovery of ESA-listed Oregon spotted frog under the No Action Alternative.

Alternative B – Preferred Alternative

Under Alternative B, habitat characteristics required by Oregon spotted frog would increase, including areas inundated for more than 4 months per year, aquatic movement corridors and areas of dense vegetation that could serve as refugia. Improvement of fish passage within the Project Area would benefit this ESA-listed species. Limiting in- and near-water construction activities to the late-summer and early-fall dry season, after the irrigation season and at the lowest seasonal river elevation, and implementation of BMPs described in the 2010 CCP to protect sensitive species, wetland and riparian resources would avoid and minimize effects on spotted frogs and important physical and biological elements of designated critical habitat for spotted frogs.

3.6 Noise

The ambient sound level in the Project Area is made up of noise sources that are typical of rural areas. Traffic is one of the largest contributors to the background sound levels due to the proximity of Silver Lake Highway and US 97 to the Project Area. The noise level from traffic is dependent on the speed, type of vehicle (e.g., trucks are louder), the volume of traffic and the condition of the vehicle, particularly the muffler. Some of the other noise sources in the Project vicinity making up the background sound level include farm equipment operation, aircraft overflights, children playing, dogs barking, boat engines, waterfowl (e.g., honking geese), cattle sounds (e.g., mooing) and the discharge of firearms from hunters. Sound levels are higher on weekends and summers from increased traffic on the area roads. Some examples of typical sound levels are: 90 A weighted decibels (dBA) for a heavy truck at 50 feet, 100 dBA for a noisy motorcycle at 50 feet or a lawn mower at 3 feet, and 110 dBA for a chain saw or noisy snowmobile (EPA 1974).

Average outdoor ambient noise levels in the Project Area likely range from 50 to 65 dBA. The Federal Highway Administration has identified 67 dBA as a suitable upper level of acceptability for outdoor activities such as parks, picnic areas and recreation areas (23 CFR 772). Sensitive receptors to noise in the Project Area include big game, waterfowl and other wildlife.

<u>Alternative A – Current Management (No Action)</u>

There would be no change to the ambient level of noise in the Project Area.

<u>Alternative B – Preferred Alternative</u>

Construction noise can affect wildlife and migratory birds by disrupting natural behaviors such as foraging and nesting, as well as creating annoyance for humans. Factors affecting the sound transmission and the potential related noise impact include distance from the source, frequency of the sound, absorbency of the ground surface, the presence or absence of obstructions and their absorbency or reflectivity and the duration of the sound. The degree of impact on humans may also depend on existing sound levels and who is listening. For example, if existing sound levels are high, introducing a new noise source tends to have less impact than in an environment in which background noise levels are low. Wildlife and bird species that are sensitive to indirect human disturbance (noise and visual disturbance) would be impacted most during the construction activity.

USFWS developed an appendix to the Klamath Basin Ecosystem Restoration Office Projects 2000–2010 Environmental Assessment that described various types of restoration activities and their construction noise effects on habitat (USFWS 2000). Several of the construction activities would likely have similar noise effects, such as the use of heavy machinery for installing instream structures. This type of activity was estimated to have moderate to high levels of noise and short- to mid-term impacts on aquatic habitat and upland habitat disturbance, respectively. Removal of major water control structures is anticipated to produce similar effects (i.e., moderate to high noise levels) from construction noise. Once construction is completed, no further adverse noise effects occur.

3.7 Air Quality

One air quality monitoring station in the Project Area located on Duke Drive in Chiloquin is part of the Oregon Department of Environmental Quality's air monitoring system. This station monitors fine particulates (PM2.5), which are largely the result of smoke from the use of wood stoves. Wood stove use becomes more of a problem during the winter, when use increases and temperature inversions (stagnate air) can trap pollutants close to the ground, resulting in a buildup of particulates. Periodic outdoor burning (including prescribed burning by U.S. Forest Service) and wildfires generate smoke and contribute to the release of particulates. Some land management practices, such as farming and grazing, may produce particulates in the form of dust and exhaust emissions from vehicles and farm equipment.

The not-to-exceed standard for PM2.5 is 35 $\mu g/m^3$ for the daily (24-hour) period and 12 $\mu g/m^3$ for the long term. These limits were not exceeded in 2020 in the Project Area (ODEQ 2020). Other air criteria pollutants (e.g., carbon monoxide, nitrogen oxides, ozone) are generally not an issue due to limited sources in the area, although these are generated by mobile sources (e.g., cars, trucks, farm vehicles).

Greenhouse gas (GHG) emissions are produced in the vicinity of the Project and are the result of several sources, including livestock and agricultural practices; burning fossil fuel by vehicles and equipment (transportation accounts for the largest share of GHG emissions); wood stoves; and prescribed burning by the U.S. Forest Service. However, these emissions are not extensive due to the sparsely populated area, relatively low volumes of vehicle traffic in the area and the presence of extensive stands of forest trees and vegetation, which capture carbon dioxide in the atmosphere.

Alternative A – Current Management (No Action)

No change to the ambient air quality conditions would occur under the No Action Alternative.

Alternative B – Preferred Alternative

Construction activities involved in removing major water control structures would generate dust during soil disturbance, and construction vehicles and equipment would generate exhaust emissions, temporarily increasing the amount of particulates and GHG in the work area. A quantitative GHG analysis was not conducted, but effects are not anticipated to be significant due to the relatively short construction period, small amount of construction equipment required and low existing levels of GHG emissions. Proposed construction equipment consists of a D-9N Caterpillar tractor with a single shank ripper and a 235C Caterpillar excavator with a medium stick and rock ripping bucket, or equivalent equipment. Once completed, the Project would not generate any air quality issues. The increase in vegetation would help to lessen GHG in the atmosphere by sequestering carbon.

3.8 Transportation

The existing road transportation network in the general vicinity of the Project is made up of national and state highways, county roads, private roads and national forest service roads (Figure 2). The primary transportation and freight route in the area is US 97, which generally runs in a north-south direction along the east shore of Upper Klamath Lake and Agency Lake. US 97 extends from Weed, California, north to the border of Canada near Oroville, Washington. Oregon Department of Transportation operates permanent automatic traffic recorders on US 97 near Modoc Point and Chiloquin. The average daily traffic volume in 2018 was 6,600 vehicles at Modoc Point and 4,700 vehicles at Chiloquin (ODOT 2019). The general breakdown of vehicles by classification at the Chiloquin recorder in 2018 were 2.4 percent motorcycles, 53.1 percent passenger cars, 18.2 percent pickup trucks, 5 percent buses and 21.3 percent commercial trucks (ODOT 2019).

State/county highways in the area include Silver Lake Highway (OR 676). OR 676 is located south and east of the Project Area and extends from US 97 east to the Klamath/Lake County line. Average daily traffic volume counts were unavailable for this segment of OR 676 in the vicinity of the Project. Other major local roads in the vicinity include the Military Crossing Road, an improved gravel/cinder road that is maintained year-round by Klamath County. General vehicle use is associated with outdoor recreation, logging, ranching and access to private lands.

Administrative access to the Project Area is possible through Kirk Road, adjacent to the Cholo and Kirk ditch system. There is no legal access route for the general public, and the Project Area is not currently open to the general public. The Klamath Tribes maintain subsistence treaty rights to hunt, trap, gather and fish within the Refuge.

<u>Alternative A – Current Management (No Action)</u>

The current management of the Project Area would not change or affect access and would not adversely affect the current transportation system.

<u>Alternative B – Preferred Alternative</u>

A temporary increase in construction traffic volumes would occur on area roads due to construction workers and equipment accessing the work site. Even though construction truck traffic would temporarily increase, the area roads have sufficient capacity given that traffic volumes are extremely low in the Project Area. The need for closing any public roads or controlling traffic (e.g., with flaggers, cones or detours) is not anticipated.

3.9 Visual Resources

Federal land use management agencies have developed a variety of methods for describing landscapes and analyzing the impacts on the scenic quality of a landscape. The common goal of these methods is to apply objectivity and consistency to the process and reduce the subjectivity associated with assessing a landscape's visual quality.

Visual resources are a composite of basic terrain, geologic features, water features, vegetative patterns and land use effects that typify an area and influence the visual appeal that an area may have to people. The opportunity to experience the landscape and interpret scenery and visual change is dependent upon the degree of public access and use of an area.

The scenic character of the Project Area is strongly influenced by the surrounding wetland complexes, the forested mountainous terrain and the waters of the Williamson River. The Project Area lies in the center of Klamath Marsh and is bordered by dry conifer forest. The marshland area is colored with green and brown vegetation. The west side of the Project Area lies adjacent to private land that is used for seasonal housing, timber harvest and ranching.

The valley is flanked by higher elevations to the east and west, including Mount Yamsay, God Butte, Mount Mazama and Mount Thielsen. These mountainous areas have a mix of extensive stands of ponderosa and lodgepole pines, with western hemlock and white fir at higher elevations. This vegetation frames the valley area with a dark green color and uniform texture, creating a strong contrast with the valley floor. Mount Thielsen is a scenic feature in the landscape and is topped with snow into late spring.

Colors in the Project Area change seasonally. Spring and early summer offer varying shades of green and brown, with foliage softening the views of landforms. Many pastures and farmed land towards the western boundary turn brown during the summer and early fall. In winter, a blanket of snow colors the area uniformly white, punctuated by colors and textures created by the forested area.

<u>Alternative A – Current Management (No Action)</u>

Under the No Action Alternative, no changes to the visual landscape, including views of the Project Area, are expected.

<u>Alternative B – Preferred Alternative</u>

During construction, views of the Project Area would be temporarily altered because some vegetation would be removed and soil exposed. Soil becomes more noticeable when newly exposed because the brown soils contrast sharply with the greens of the forested terrain surrounding the valley, temporarily affecting visual quality.

3.10 Visitor Use

Outdoor activities in the general Project Area that attract visitors to the Refuge are limited. These activities include Tribal subsistence rights related to hunting, fishing, trapping and gathering, nature viewing, interpretive information kiosks and photography. Visitor use and experience are restricted to the public road system and informational kiosk pullouts located at Silver Lake Highway, Military Crossing Road, Wocus Bay and Headquarters. However, the Project Area itself has no formal visitor or interpretive facilities. The interior of the Refuge is closed to public access unless the individual is a member of the Klamath, Modoc and/or Yahooskin Tribes.

Visitor information services for the KMNWR are located at the Refuge Headquarters building in Oregon. Other notable destinations in the area are Crater Lake National Park and the Kla-Mo-Ya Casino, located about 22 miles north of Klamath Falls and 8 miles south of central Chiloquin. This casino is managed by the Klamath Tribes.

<u>Alternative A – Current Management (No Action)</u>

No change to any of the visitor services described above would occur under this alternative.

<u>Alternative B – Preferred Alternative</u>

Some temporary minor impacts on visitor experience may occur during construction, as some visitors may be slightly affected by construction activities associated with removing major water control structures and terraforming levees. Construction noise and activities may temporarily displace waterfowl and other wildlife due to noise and human activity, limiting the opportunity to view wildlife. Access issues due to construction are not anticipated, and no long-term adverse impacts on visitor use and experience would occur following construction.

Although the Project Area would be inaccessible to visitors, the Project would generate additional habitat for fish and wildlife, which would improve the success of hunting and fishing in the general area and increase the opportunities for bird watching and wildlife photography.

3.11 Cultural Resources

The Project Area is located within the traditional territory of the Klamath Tribes (Klamath, Modoc and Yahooskin) and became the Klamath Indian Reservation in 1864 through a government treaty. In 1954, the U.S. government was deeply involved in forceful efforts to assimilate Native American tribes across the country, and Congress successfully terminated the Klamath Indian Reservation. In 1960, the U.S. Fish and Wildlife Service purchased the first tract of land that established the Refuge. Federal recognition of the Klamath Tribes was restored in 1986, and the Tribes legally regained their subsistence rights through the 9th Circuit Court in 1981 (USFWS 2010).

Archaeological records clearly show the long history of the First People inhabiting Klamath Marsh. Despite decades of illegal artifact looting, isolated artifacts can still be found and are now protected within the Refuge.

Tribal consultation was initiated via email with USFWS cultural resources staff of the Klamath Tribes, Burns Paiute Tribe, Fort Bidwell Indian Community and Confederated Tribes of the Warm Springs Reservation of Oregon on April 17, 2023. The Klamath Tribes responded with a request to conduct a cultural resource survey. Tribal consultation has been ongoing with the Klamath Tribes. No additional responses have been received.

State Historic Preservation Officer (SHPO) consultation was initiated via email on April 17, 2023. A cultural resource survey will be conducted for the Project in spring or summer 2023.

Alternative A – Current Management (No Action)

No change to any of the cultural resources described above would occur under this alternative.

Alternative B – Preferred Alternative

Removal of major water control structures has the potential to uncover or disturb archaeological resources or archaeological materials disturbed during channel construction and incorporated into the current structures.

The Preferred Alternative could provide the most potential opportunities for Native American anglers, hunters and gatherers to practice traditional subsistence within the Project Area. Removal of fish barriers could provide increased hunting, fishing and gathering opportunities for Tribal members.

USFWS does not anticipate that this action will adversely impact any Tribal trust or Klamath Tribe treaty rights. The Service expects Tribal trust resources to improve and increase over time with river and floodplain restoration in later phases. The Preferred Alternative is not anticipated to result in cumulative impacts on historical, architectural, archaeological or cultural resources.

If inadvertent discoveries are encountered during construction, work in the area would immediately halt and specific measures would be taken to ensure that the discoveries are handled appropriately. The construction contract would contain the following provision:

If unrecorded cultural resources are discovered during ground-disturbing activities, all work in the immediate vicinity of the cultural resource will stop and the project manager will immediately notify the USFWS and the Oregon SHPO. No work shall resume at the discovery location until an archaeologist designated by the USFWS surveys and records the location and issues a written notice allowing work to resume.

Work would not resume at the location(s) until Section 106 consultation is conducted with USFWS and the SHPO. The USFWS shall adhere to BMPs described for cultural resources in Appendix L of the CCP, Sections 60 through 63 (USFWS 2016).

3.12 Socioeconomics

Population

The Project Area is located within rural Klamath County, approximately 61 miles north of the city of Klamath Falls and 33 miles north of the town of Chiloquin. The Project vicinity is remote, with few residents. The area of analysis for the regional economy includes Klamath County, the City of Klamath Falls and the Town of Chiloquin.

The population in the county is sparse, with a density of 11 people per square mile. Table 2 shows the estimated population and the change over the past 10 years for the state, Klamath County and the closest towns. The county had a 2019 estimated population of 68,238 and Klamath Falls had an estimated population of 21,753. The county and city had similarly increased rates of population growth (2.8 percent and 3.6 percent, respectively) over the past 10 years but lagged the state's growth rate (10.1 percent). The Chiloquin population in 2019 was estimated at 980. In contrast to Klamath Falls and Klamath County, the rate of population growth of the Town of Chiloquin exceeded that of the state (U.S. Census Bureau 2020).

Table 2. Population Change in the Region of the Project from 2010 to 2018/19

Geographic Area	2010 Population	2019 Population (estimated)	2010 to 2019 Change	Average Annual Growth Rate
Oregon	3,831,074	4,217,737	10.1%	1.12%
Klamath County	66,380	68,238	2.8%	0.31%
Klamath Falls	20,753	21,753	3.6%	0.40%
Town of Chiloquin	734	980	33.5%	3.72%

Local and Regional Economy

Klamath County is home to the City of Klamath Falls, the largest municipality near the Project Area. Located in the south-central region of Oregon and bordering Northern California, Klamath Falls sits on the southern shore of the Upper Klamath Lake about 61 miles south of the Project Area. Klamath Falls offers a variety of outdoor recreation, such as cross-country skiing, golfing, fishing, hunting and canoeing. It is known for bird watching and is home to some of the highest wintering concentrations of bald eagles in the Pacific Northwest. It also offers arts and culture, with numerous antique shops, museums and theaters. Klamath Falls has experienced a boom in the past few years, with several large housing developments being built and many new businesses locating to the area. The Klamath Tribal Headquarters is located in the Town of Chiloquin. The Kla-Mo-Ya Casino is located about 22 miles north of Klamath Falls and 8 miles south of central Chiloquin. This casino was opened in 1997 and is managed by the Klamath Tribes.

Employment in the county as of April 2020 is shown in Table 3. Primary sources of employment and revenue are in the government (25.5 percent), education and health services (19.7 percent) and wholesale and retail trade (16.8 percent) sectors of the economy. This data source does not track agriculture, which is also a primary source of employment in the region (see the following paragraph). Included in the government sector is employment in the operation of the Upper Klamath Lake Refuge. "Refuge operations contribute to levels of industry output, employment and personal income in the study region" and benefit the agricultural, Federal government and tourist-servicing industries (USFWS 2010).

One of the economic drivers in the county is agriculture, which is not represented in Table 3; the employment in agriculture in 2017 was 1,342 jobs (USDA 2017). Because of the dry weather conditions, farm production in the area is dependent on irrigation. Management of the water supply for irrigation has become an issue of concern due to ongoing drought conditions.

The unemployment rate in Klamath County steadily dropped between 2010 and April 2020, when the rate was 12.9 percent. It dipped to a low of 5.9 percent in 2017 and was 6.2 percent in 2019 (Oregon Department of Employment 2020). The rate for the state as a whole was similar, with a downward trend from a high of 10.6 percent in 2010 to a low of 3.7 percent in 2019.

Current average wages by industry for the county and state are shown in Table 4. As expected for a more rural county, wages are lower for almost all sectors compared to the state's average wages, except for natural resources and mining—rural counties typically rely more on jobs in the natural resources industries. Generally, the average wages in the county are very similar across most of the industry sectors, with wages somewhere between $40,000 and $50,000 per year. The 2018 median household income was $43,522, and the per capita income level in the county was $24,296 (U.S. Census Bureau 2020).

Table 3. Current Employment for Klamath County (April 2020)

Industry (Non-farm Employment)	Employees	Percent
Mining, Logging, and Construction	840	4.2
Manufacturing	1,570	7.8
Wholesale and Retail Trade	3,360	16.8
Transportation and Utilities	630	3.1
Information	110	0.5
Finance, Real Estate, and Insurance	850	4.2
Professional and Business Services	1,410	7.0
Education and Health Services	3,950	19.7
Leisure and Hospitality	1,500	7.5
Other Services	690	3.4
Government	5,110	25.5
Total Non-farm	20,020	-

Table 4. Average Annual Wages by Industry

Industry	Klamath County	State of Oregon
Natural Resources and Mining	$40,143	$37,561
Construction	$46,984	$63,164
Manufacturing	$48,347	$71,434
Trade, Transportation, and Utilities	$34,166	$45,881
Information	$40,133	$89,699
Financial Activities	$48,382	$73,314
Professional and Business Services	$40,533	$73,469
Education and Health Services	$46,939	$51,846
Leisure and Hospitality	$19,103	$23,798
Other Services	$22,274	$35,551
Government	$49,811	$61,258

Table 5 shows the history of grazing and hay harvesting on Klamath Marsh. Records for haying and grazing prior to 2010 are noted in the CCP (USFWS 2010, Figures 3-18 to 3-25). Records prior to 2010 indicate that grazing and haying were intermittent on the KMNWR for decades. Listed in Table 5 are data from 2010 to 2021. All the grazing and haying occurred on T30S R9E in Sections 21 thru 28. The actual areas, acreage and dates of grazing varied from year to year due to wet conditions and/or water levels. Lease payments are currently not required for grazing rights in the Project Area, and grazing only occurs for the purposes of wildlife habitat management.

Table 5. History of Grazing/Haying in the Project Area

Year	Grazing Acres (AUM)*	Hay Harvested (tons)
2010	1,612	161
2011	1,896	419
2012	2,709	344
2013	2,659	259
2014	2,035	180
2015	No Grazing	No Haying
2016	1,402	664
2017	1,141	477
2018	1,223	193
2019	690	205
2020	1,205	No Haying
2021	No Grazing	No Haying

* One animal unit month (AUM) is defined as the amount of forage required for one cow/calf pair for one month.

Hunting, fishing and tourism are other activities that occur near the Project Area and generate revenue. Hunting and fishing licenses generate modest revenue for the state (for example, a hunting license for an Oregon resident is $34.50). Individuals hunting, fishing, birdwatching or visiting the area may spend money that mostly benefits tourist-serving businesses and wildlife conservation.

Alternative A – Current Management (No Action)

Current management of the units would not change, and the property could continue to be used for limited cattle grazing to achieve wildlife habitat goals and objectives. There would be no changes to employment or population in the area.

Alternative B – Preferred Alternative

This alternative would produce some temporary construction-related jobs associated with major water control structure removal and channel reconstruction. These jobs would likely be local, and the employment and income would accrue to Klamath County residents. Some local spending in Chiloquin may also result from construction workers. Overall, these economic benefits would be negligible due to the small work crew and short construction duration. This alternative would not generate any changes to population.

3.13 Cumulative Impact Analysis

Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). This section describes other past, present and reasonably foreseeable activities impacting the affected environment.

The U.S. Bureau of Reclamation authorized the Klamath Project in 1905, which initiated construction of facilities, including six dams, in the Upper Klamath Basin. Klamath Project dams provide hydropower and are managed to divert water for irrigation and for flood control (USFWS 2016). The Klamath Project resulted in draining of an estimated 85 to 90 percent of the extent of historical wetland habitat in the Klamath Basin (Ivey 2001).

The widespread shallow lake and marsh habitat in the Klamath Basin historically supported up to six million waterfowl in the fall and provided important nesting and brood-rearing habitat (Ivey 2001). Dams, water diversions and instream fish passage barriers resulted in substantial adverse effects on waterbirds and other wildlife, including considerable decline of endemic fish species (Ivey 2001). Record droughts in recent years have contributed to the effects of wetland and open water habitat losses (Ivey 2001).

Past and planned restoration projects in the Upper Klamath Basin are contributing to mitigation and reversal of historical landscape alteration effects on native habitat and species. Upstream of the Project Area, restoration efforts are being coordinated with private landowners and The Klamath Tribes. The Klamath River Renewal Corporation proposes to remove four hydroelectric developments—J.C. Boyle, Copco No. 1, Copco No. 2 and Iron Gate—on the Klamath River downstream of the Project Area. The dam removal would provide free-flowing conditions and volitional fish passage to salmonids and lamprey in the Klamath River and would contribute to water quality improvements by reducing blue-green algae (KRRC 2020).

Over time and with future phases, the Preferred Alternative would result in incremental increases in water storage, water quality and wetland habitat in the Klamath Basin. These increases, in combination with other ongoing and planned restoration projects in the area, would contribute to a positive cumulative impact on fish and wildlife resources.

Climate models predict an increase in annual average temperature in the Pacific Northwest of between 2.1 °F and 3.6 °F by 2050, resulting in increased evaporation and evapotranspiration, which would decrease water availability in the basin (USFWS 2016, 2019). The Preferred Alternative, in combination with other restoration projects in the area, would help to mitigate the potential impacts on water availability from climate change to a small degree by increasing carbon sequestration through expanded wetland vegetation extent. Alternative B would provide minor improvements in evapotranspiration reductions, and hence, would incrementally contribute to increased water availability in the basin. In contrast, under the No Action Alternative, no benefits to water storage or wetlands and wildlife habitat are expected.

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CHAPTER 4 – CONSULTATION AND COORDINATION

4.1 Compliance

Cultural Resources, Clean Water Act and Section 7 Endangered Species Consultation are in the initial stages of discussion with the appropriate agencies/individuals.

The Assistant Regional Director, Refuges, will decide, after evaluating potential impacts of the alternatives, consultation with the Klamath Tribes, and public comment, which alternative will best achieve the goals of the proposed action. The Project Leader will also determine, based on the analysis herein and public comment, whether implementation of the Preferred Alternative will result in significant impacts on the human and natural environment, thereby requiring preparation of an Environmental Impact Statement.

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CHAPTER 5 - REFERENCES

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