Walúula Floodplain Restoration

PRE-DESIGN RECONNAISSANCE REPORT

COLLABORATIVE REPORT WITH THE CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION AND THE UNITED STATES FISH AND WILDLIFE SERVICE

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Introduction

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and the United States Fish and Wildlife Service (USFWS) are partnering to develop a large-scale (~1200 acre) habitat restoration and enhancement project on the McNary National Wildlife Refuge – Wallula Unit (the Refuge). Because the Walla Walla River is the last unconfined river delta in the Middle Columbia River that remains relatively undeveloped, it presents an unparalleled conservation opportunity. CTUIR and USFWS (the Partners) are mutually interested in restoring and enhancing floodplain, wetland, and instream habitats for the benefit of fish and wildlife species. The primary goal of the design is to achieve restoration actions on the Refuge that meet the goals of both partners.

The purpose of this document is to consolidate and summarize the existing data and define the project goals and objectives by defining desired future conditions for the Refuge. A consultant will be hired by CTUIR using Washington State Recreation and Conservation Office (RCO) Salmon Recovery Funding Board (SRFB) dollars to conduct site specific analyses and to develop an alternatives analysis and conceptual design for restoration on the Refuge. This initial contract will lay the groundwork necessary to develop a clear and robust project in the Refuge. This reconnaissance report is intended to outline the sideboards for restoration activities and provide background data to the consultant. It is the hope of the Partners that restoration can be achieved while maintaining Refuge management directives.

The primary habitat targeted by the Partners on this Project is riverine and associated floodplain, wetland, and riparian habitat. This Project will identify and develop opportunities to encourage large-scale restoration of river processes, reconnect floodplain and increase channel complexity, and enhance the riparian areas for fish and wildlife species.

Partners

USFWS

The United States Fish and Wildlife service is the only agency in the federal government whose primary responsibility is the conservation and management of fish, wildlife, plants and their habitats for the benefit of the American people. This includes acquiring, protecting and managing unique ecosystems necessary to sustain fish and wildlife. The USFWS manages a network of public lands and waters under the National Wildlife Refuge System.

McNary National Wildlife Refuge was established in 1956 under the authority of the Fish and Wildlife Coordination Act to mitigate for inundation of wetland and riparian habitats from the construction of the McNary Lock and Dam. The establishing purpose of the Refuge was “for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon” (US DOA et al. 1953). Goals from the Comprehensive Conservation Plan for the Refuge (USFWS 2007) include: Manage high quality food and sanctuary to support large concentrations of migratory waterfowl; Provide secure and productive foraging and nesting habitats for a diversity of shorebirds; Contribute to the recovery of endangered, threatened, and sensitive species by protecting, maintaining, or increasing suitable habitats; Provide a diversity of high quality wetland habitats for the benefit of migratory birds and other wetland plants, and animals, and; Provide high quality riparian habitats for the benefit of nesting and migrating birds, fish, riparian plants, and other riparian wildlife. This plan also contains public use goals to promote enjoyment by all visitors, including local residents, hunters, anglers, students, and teachers. Recreational activities supported by the Refuge include hunting, fishing, wildlife viewing, horseback riding, and non-motorized boating.

The Wallula Unit of the Refuge provides some of the most important habitat on the entire Refuge for wildlife, including a great diversity and abundance of waterfowl, shorebirds, wading birds, reptiles, amphibians, ESA-listed Mid-Columbia Summer Steelhead and Bull Trout, and native plants. This wildlife is supported by the river and associated marsh and riparian habitats. Protection, enhancement, and restoration of the floodplain, channel and watershed processes of the lower Walla Walla River on the Wallula Unit is one of the greatest opportunities on the Refuge to benefit wildlife and the habitats they depend on.

CTUIR

The Walla Walla subbasin has been home to the Walla Walla, Umatilla, and Cayuse tribes (collectively, CTUIR) since time immemorial. Euro-American colonization of the subbasin led to land use changes over time that have resulted in degradation of aquatic habitat including simplified channel characteristics, disconnected floodplains, degraded riparian condition, degraded water quality, reduced water quantity, and barriers to fish migration. By 1999, spring Chinook Salmon and Pacific lamprey had been extirpated from the subbasin and summer Steelhead and Bull Trout were listed as threatened under the Endangered Species Act of 1973 (ESA).

The Walla Walla River subbasin is entirely contained within the 6.4 million acres ceded by CTUIR to the United States government in the Treaty of 1855. People of the CTUIR rely on the availability of First Foods (water, salmon, deer, cous, and huckleberry, in the traditional serving order) as a foundation for their culture, economy, and religion (Karson 2006; Quaempts et al. 2018). In 1996, the CTUIR Fisheries Department initiated the Walla Walla River Fish Habitat Enhancement Project to protect, enhance, and restore functional floodplain, channel, and watershed processes to provide sustainable and healthy habitat for aquatic First Foods species.

The CTUIR Department of Natural Resources operates under a First Foods-based approach to environmental management, organizing actions and priorities around the principles of reciprocity and ecosystem resiliency (Jones et al. 2008; Quaempts et al. 2018; Endress et al. 2019). The Umatilla River Vision provides the guiding principles for the CTUIR Fisheries Habitat Program, which is largely organized around five functional "Touchstones" related to riverine and watershed processes: water quantity and quality, geomorphology, connectivity, riparian vegetation, and aquatic biota (Jones et al. 2008). Protecting, enhancing, and restoring functionality of these physical and biological Touchstones, and the interactions and connectivity between the Touchstones, is required to sustain First Foods and to recover ESA-listed native fish species. The mission of the CTUIR Fisheries Program is to provide sustainable harvest opportunities for aquatic species of the First Foods order by protecting, conserving, and restoring native aquatic populations and their habitats. In support of this, the Habitat Program mission is to protect, enhance, and restore functional floodplain, channel and watershed processes to provide sustainable and healthy habitat for aquatic First Food species.

Location

McNary National Wildlife Refuge

The McNary National Wildlife Refuge (McNary NWR), located in rural Burbank, Washington, includes several units extending along the east bank of the Columbia River in southeastern Washington, from the confluence of the Snake River to the mouth of the Walla Walla River, and downstream into Oregon. The entire refuge includes 15,000 acres of sloughs, ponds, streams, islands, riparian woodlands and emergent marsh,—as well as upland shrub-steppe and cliff-talus habitat that are important to migratory waterfowl, shorebirds and songbirds.

McNary NWR wetland habitat was created by the damming of the Columbia River. Although more wetland habitat was formed, the dam highly altered the natural ecosystems and provided management challenges for the USFWS. The challenges faced by the USFWS include artificial river operations, widespread nonnative invasive plant and animal species introduction, and extensive land use conversion and fragmentation. Management of seasonal wetlands involves the manipulation of water levels to encourage native food supplies and promote the diverse wetland plant growth that provides a variety of food and shelter for wildlife. Some wetlands are burned, mowed and disked to remove undesirable plant growth, regenerate native plants and create open areas. Shoreline burning and mowing also create open beach areas that waterfowl use for courting, feeding, resting and raising young. Seasonally flooded wetlands provide resting and feeding areas and are especially important to waterfowl and shorebirds during fall migration.

Riparian areas supply food, plants, water, nesting sites, and shelter for a wide variety of wildlife. Cottonwoods and willows in riparian areas provide essential nesting habitat for migratory songbirds like yellow warblers and Bullock’s orioles. Management practices in riparian areas include planting native willows and cottonwoods and control of introduced invasive plants. Upland areas, replete with sagebrush, rabbitbrush and bunchgrasses, provide forage for deer and nesting sites for songbirds, ducks, and ground nesting birds. Refuge managers improve uplands through prescribed burning, removal of exotic weed species, and planting of native grasses.

Approximately 700 acres of refuge lands are irrigated croplands, which provide food and cover for wildlife. Farmers grow corn, buckwheat, alfalfa and other crops under a cooperative agreement whereby the refuge's share of the crop is left in the field for wildlife. These crops provide an extremely valuable source of high energy food for waterfowl, especially in winter when other food sources may be exhausted or covered by snow. This value is compounded as area wetlands have been degraded by invasive plants which has drastically reduced the availability of wild foods. Further, more efficient harvest practices leave very little waste grain on surrounding agricultural lands.

Wallula Unit

The Wallula Unit of the Refuge is located on the Walla Walla River at the confluence with the Columbia River (Figure 1). The unit extends from the Walla Walla river delta upstream to river mile 8 and includes the former Madame Dorian Memorial Park. The Wallula Unit is 2,264 acres. Approximately 1,200 acres of that area is comprised of historic floodplain. The people of the CTUIR historically used the area as a permanent village site, plant food gathering location, and fishing site (Hunn et al. 2015). The traditional place name for the vicinity is *Walúula*, meaning “little river” in the Northeast dialect of the Sahaptin language.

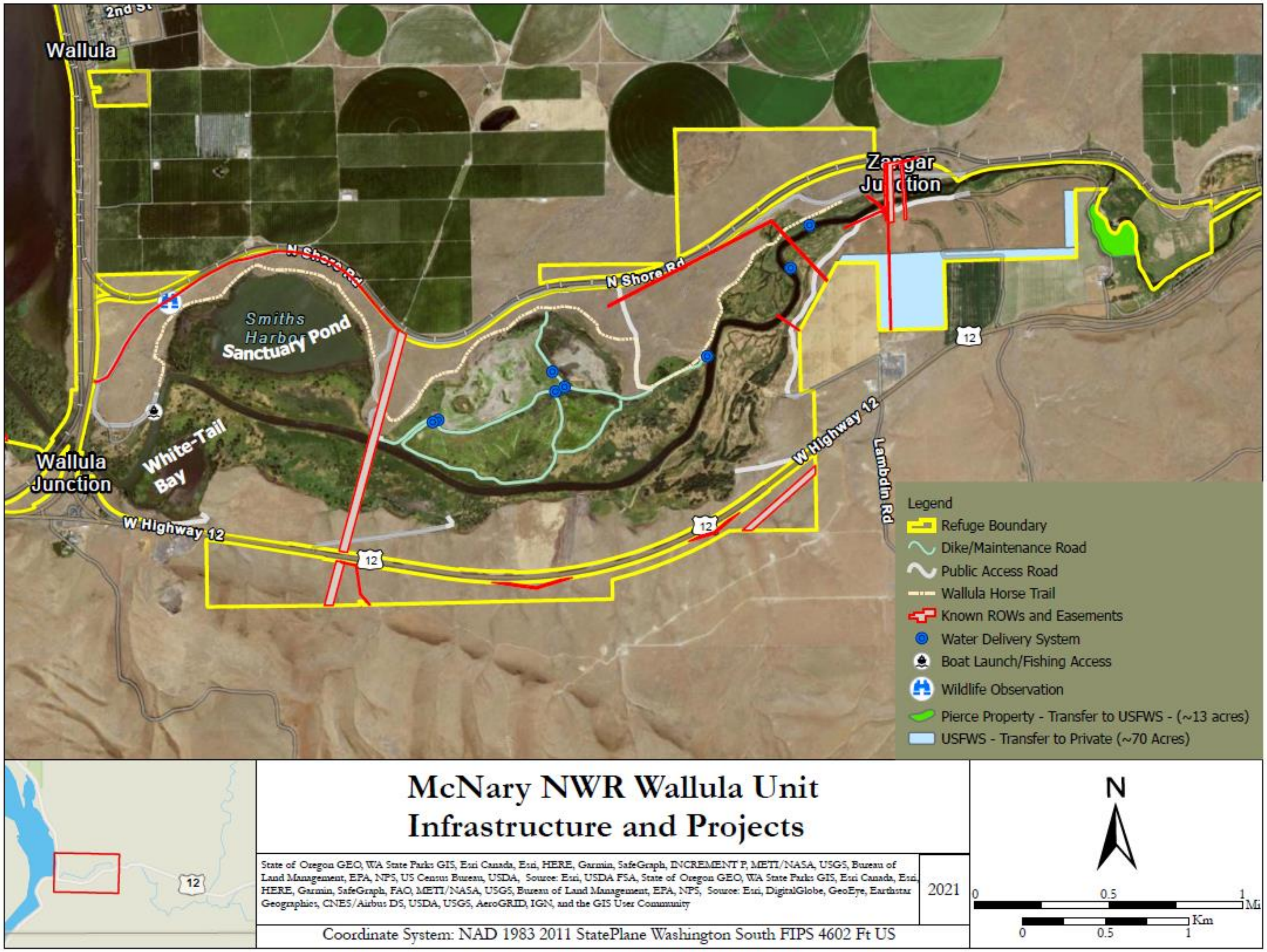

Figure 1. Map of Wallula Unit Infrastructure

The Wallula Unit is one of the most important areas of the Refuge because of its riverine, riparian, and marsh habitats. These habitats support large concentrations of migrant waterfowl, shorebirds, wading birds (Table 1), and ESA-listed Mid-Columbia Summer steelhead (*Oncorhynchus mykiss)* and Bull Trout (*Salvelinus confluentus)*. Further, this Unit is one of the most important public use areas of the Refuge. Recreational facilities such as public access roads, parking areas, a boat launch, several fishing access sites, hunting and wildlife observation blinds, and miles of trails support tens of thousands of annual visits by anglers, hunters, birdwatchers, wildlife photographers, walkers/joggers/bikers, horseback riders, and others.

Table 1. Maximum counts of waterfowl and shorebirds at the McNary NWR Wallula Unit (data from eBird.org)

Waterfowl	Max	Shorebirds	Max
snow goose	25,000	black-necked stilt	90
greater white-fronted goose	810	American avocet	80
Canada goose	3,500	black-bellied plover	80
cackling goose	2,000	killdeer	450
tundra swan	150	Baird's sandpiper	110
wood duck	330	least sandpiper	90
cinnamon teal	70	pectoral sandpiper	80
northern shoveler	500	western sandpiper	2,750
green-winged teal	600	dunlin	580
gadwall	200	long-billed dowitcher	350
American wigeon	4,800	red-necked phalarope	90
mallard	20,000	Wilson's phalarope	30
northern pintail	3,500	spotted sandpiper	40
canvasback	880	greater yellowlegs	40
redhead	1,100	lesser yellowlegs	720
ring-necked duck	460		
greater scaup	2,500		
lesser scaup	2,100		
bufflehead	200		
common goldeneye	750		
ruddy duck	480		

A large percentage of the Wallula Unit is unmanaged except for control of invasive species such as Phragmites and Russian olive. Several miles of cottonwood stands have been re-established which provide especially important habitat for nesting and migrant songbirds. The majority of the habitat management activities occur in the Millet and Woodland Ponds. Water levels in these units are controlled to yield approximately 350 acres of seasonally flooded wetlands. This management is aimed to mimic the ephemeral wetlands that historically occurred here but were lost as a result of modification of the surrounding landscape, especially the river. Water level management in these ponds yields an influx of annual wetland plants which yield a great abundance of seed, and thus carbohydrate food resources. These carbohydrates are especially important for waterfowl and songbirds. The annual plants also form the base of the food web for an abundance of invertebrates which provide protein for waterfowl, shorebirds, songbirds, amphibians, and other wildlife. Water level management also yields mudflat habitat and facilitates invasive species control.

The Walla Walla River is the last unconfined river delta in the Middle Columbia River that remains relatively undeveloped. The significant amount of wetland habitat and floodplain available on the Wallula Unit provides a rare habitat type for a wide variety of fish and wildlife species, resident and migratory, in the Columbia River basin (Figure 2). The National Wetland Inventory data shown in Figure 2 is likely not up to date with the current conditions on the site. The Project scope of work currently outlined in the Request for Proposals include appropriate wetland analyses to support the design.

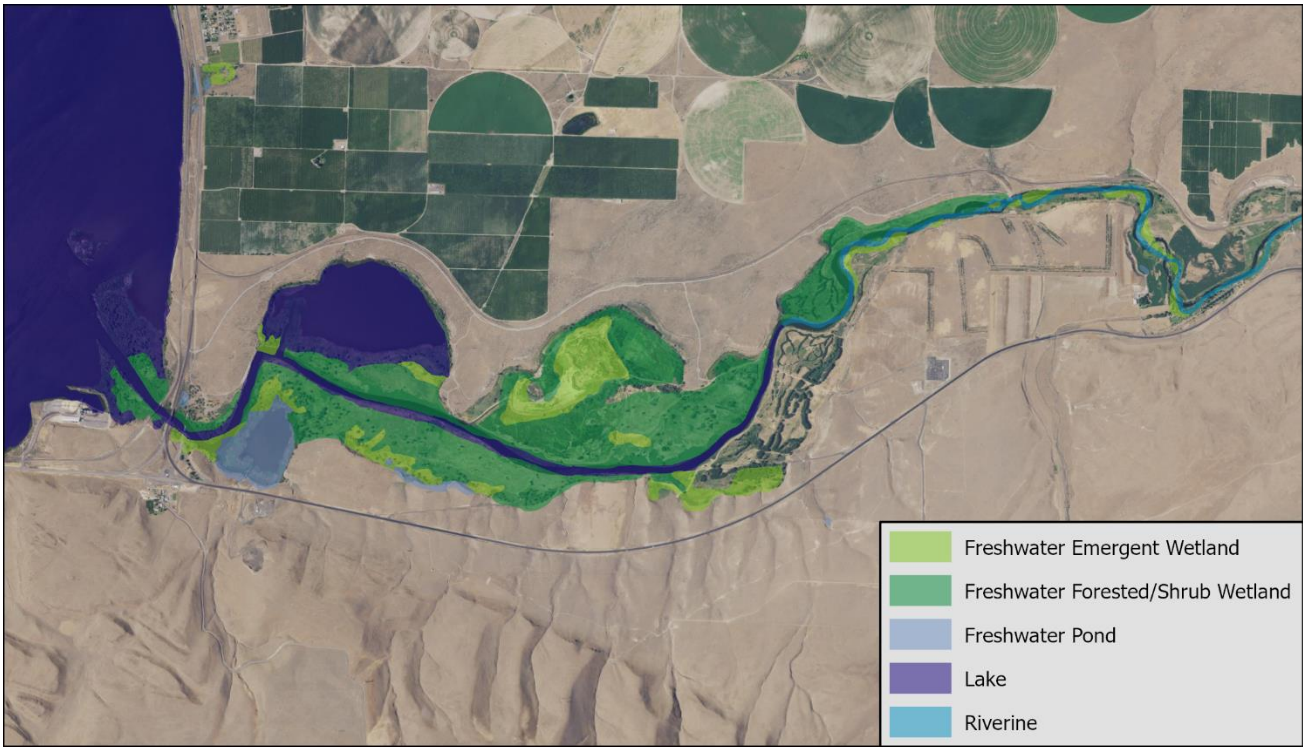

Figure 2. Map of National Wetland Inventory (NWI) delineated wetlands in the Wallula Unit.

Problem Statement

The Refuge has been identified as an important opportunity for restoration work by CTUIR to support the overall mission by improving First Food harvest opportunities on property that is accessible to tribal members. Direct and indirect impacts from anthropogenic alterations to the Lower Walla Walla River over the past century have negatively affected water quantity and quality, as well as the quantity and quality of remaining fish and wildlife habitat. These impacts have an effect on all 5 Touchstones of a healthy river ecosystem capable of supporting First Foods:

Water Quality and Quantity - Water quality in the project reach is impacted by on-site and upstream sources. The main water quality impact in the reach is high summer temperatures. The reach is 303d-listed for high summer temperatures and fecal coliform bacteria. TMDLs exist for temperature, fecal coliform bacteria, pH and dissolved oxygen, and PCBs and chlorinated pesticides.

Geomorphology - The Lower Walla Walla River is a low-gradient, primarily single-channel system, which passes almost entirely through agricultural areas. Relative to historical conditions, the Walla Walla River has been highly simplified, straightened, restricted from historical floodplains, and impacted by irrigation withdrawals.

Connectivity - Connectivity occurs in three dimensions, longitudinal (passage), lateral (floodplain), and vertical (hyporheic exchange). In the project reach, there are no known physical passage barriers to longitudinal fish migration but the channel is incised with little floodplain connection, severely limiting lateral and vertical connectivity. Limited floodplain connectivity reduces the quantity and quality of off-channel habitats used by fish and wildlife species.

Riparian Vegetation - The presence of a riparian canopy is relatively lacking or sparse within the Refuge, with the riparian zone comprising mostly understory and groundcover vegetation, including invasive species like Russian olive.

Aquatic Biota - The reduced functionality of the River Vision Touchstones described above have an overall negative effect on the aquatic biota of the Walla Walla River. High mortality among winter rearing summer steelhead and spring Chinook salmon juveniles occurs throughout the lower Walla Walla River. Lack of in-channel complexity, floodplain connectivity, and off-channel habitat limits winter rearing capacity of the reach.

Supporting Planning Efforts

This section of the Reconnaissance Report describes the supporting assessments and planning documents that were used to develop the goals and objectives for the Project.

McNary NWR Comprehensive Conservation Plan

The McNary National Wildlife Refuge Comprehensive Conservation Plan (CCP) Management Direction (US Fish and Wildlife Service 2007) provides management guidance for the Refuge. The CCP provides reasonable, scientifically grounded guidance for improving the Refuge's habitats for the long-term conservation of native plants and animals and migratory birds. The CCP also provides guidance for maintaining or improving high quality public use programs in wildlife-dependent uses such as hunting, fishing, wildlife observation, photography, environmental education, and interpretation and for non-wildlife dependent uses, including horseback riding, beach use, and boating. It addresses strategies for illegal uses on Refuge lands, including off road use and trash dumping, and provides goals and strategies for better protecting cultural resources.

Endangered Species Act recovery plans

Middle Columbia River Summer Steelhead

The Middle Columbia River Summer Steelhead DPS Recovery Plan (NMFS 2009) identifies limiting factors and restoration strategies to support recovery of ESA-listed Middle Columbia River Summer Steelhead in the Walla Walla River. In the Lower Walla Walla River, sedimentation, temperature, and low flow quantity have been identified as the primary water quality factors limiting steelhead production (NWPCC 2005; NMFS 2009; SRSRB 2011). Supporting conditions for rearing use in edge habitat include slower water, cover (safety from predators), and food source. The primary limiting factors affecting rearing habitat include streambank condition, off-channel habitat, flood refugia, LWD, and pool frequency. Recommended strategies include restoring floodplain connectivity and function, restoring channel structure and complexity, restoring riparian condition and LWD recruitment, and improving degraded water quality.

Bull Trout

The Recovery Plan for the Coterminous United States Population of Bull Trout (USFWS 2015a) identifies primary threats and restoration strategies to support recovery of ESA-listed Bull Trout range wide. Additionally, the Mid-Columbia Recovery Unit Implementation Plan for Bull Trout (USFWS 2015b) identifies specific recovery actions in the Walla Walla subbasin and throughout the Middle Columbia Recovery Unit. Primary threats for the Walla Walla and Touchet Rivers include upland and riparian land management, instream impacts, water quality, connectivity impairments, and nonnative fish competition and predation. Habitat-specific restoration strategies recommended include protecting and revegetating riparian zones, implementing measures identified in the Snake River Salmon Recovery Plan for SE Washington (SRSRB 2011), protecting floodplain and riparian function, and restoring floodplain function and channel complexity.

Local plans and assessments

Lower Walla Walla Geomorphic Assessment and Strategic Action Plan

CTUIR completed the Lower Walla Walla Geomorphic Assessment and Strategic Action Plan (CTUIR 2014) for the mainstem Walla Walla River from the town of Lowden, Washington, to the river's confluence with the Columbia River. Recognizing the importance of the Lower Walla Walla River for overwinter holding and rearing habitat for salmonids, a detailed geomorphic assessment and action plan (GAAP) was completed. This GAAP builds upon the more than four decades of past research and management efforts to more fully understand the physical and biological processes and limiting factors affecting the Lower Walla Walla River and identify and prioritize restoration and enhancement opportunities. The GAAP area includes the project area in the Refuge. Site specific limiting factors for fish were identified in the GAAP, including predation, riparian condition, appropriate channel substrate, sediment and turbidity. Large wood material, pool frequency/quality, flow conditions, and temperature were found to be highly limiting. The GAAP tiers off of several planning documents that exist for the subbasin.

Walla Walla Water 2050 Strategic Plan

The Walla Walla Water 2050 Strategic Plan (WWWMP 2021) was funded by the Washington State Department of Ecology to work collaboratively across multiple jurisdictions to develop a 30-year integrated water resource management strategic plan to ensure adequate water for fish, farms, and people. The WWW2050 plan identifies and prioritizes strategies, projects, initiatives, and programs needed to achieve the short and long-term goals for the watershed. This project supports Tier 1 strategies 1.01 "Reconnect floodplain and restore channel complexity Basin wide to reduce flood risk and improve habitat" and 1.07 "Restore and protect riparian habitat along tributaries, small streams, and the Walla Walla River Basin wide".

Walla Walla Subbasin Plan

The Northwest Power and Conservation Council (NPCC), Bonneville Power Administration (BPA), NMFS, and USFWS have adopted the Walla Walla Subbasin Plan (NPCC 2005) to help meet requirements under the 2000 Federal Columbia River System Biological Opinion. The Walla Walla Subbasin Plan does not include this reach in a priority restoration area, although the underlying EDT analysis did. The area was excluded due to concerns for practicality of restoration in the area and only portions of salmonid life histories being spent in the area. In section 3.6.4, page 61, it states "While it did not seem off base for the EDT model to see this area as prime for restoration given its degraded condition; it does seem impractical at this time to do restorative work in the area." With cooperation from USFWS and publicly owned land, the Partners believe that it is no longer impractical to do restorative work here.

Snake River Salmon Recovery Plan for SE Washington

The federal Endangered Species Act (ESA) requires National Oceanic and Atmospheric Administration (NOAA) Fisheries to write a recovery plan for all listed species. NOAA Fisheries, the Governor's Salmon Recovery Office (GSRO), and local partners developed the Snake River Salmon Recovery Plan for SE Washington (SRSRB, 2011) in 2006 and updated it in 2011. Species and populations of interest in this plan include Bull Trout, summer steelhead, and spring/summer Chinook Salmon (*Oncorhynchus tshawytscha*) within the Southeast Washington Management Unit, including the Walla Walla River. The SRSRB (2011) describes limiting factors and threats to steelhead in the Walla Walla River (mouth to Dry Creek), including lack of pool habitat, habitat diversity and channel stability. Recently, the Snake River Salmon Recovery Board and the Regional Technical Team have designated this reach as a Migration Corridor Priority Reach citing the importance of overwintering habitat in the mainstem Walla Walla River.

Walla Walla River Ecological Flows Report

CTUIR commissioned the Ecological Flows Report (2013) to develop instream flow prescriptions to support the recovery and maintenance of local fisheries, focusing on spring Chinook Salmon, steelhead, and Bull Trout. The prescriptions include instream flows that optimize, where feasible, the fishery and related habitat maintenance benefits. The instream flow prescriptions do not anticipate that all of the Walla Walla Basin flow is necessary to meet an optimum level of benefit, but only considers those flows that provide the most benefit before reaching a point of diminishing gain. In addition, flow prescriptions are made to support the riverine ecosystem that produces a more natural and healthy floodplain function consistent with the CTUIR River Vision (Jones et al. 2008). Continuity of habitat, healthy riparian vegetation and riverine biota, and connectivity of the river with the floodplain is provided by elements of a natural hydrologic regime (Jones et al. 2008), and these elements were considered in the flow prescriptions.

ESA-listed Fish Species

Among the native salmonids in the Walla Walla River, Bull Trout and steelhead, are listed as threatened under the Endangered Species Act (ESA). The National Oceanographic and Atmospheric Administration, National Marine Fisheries Service (NMFS) and the USFWS have developed recovery plans (see Middle Columbia River Steelhead Distinct Population Segment ESA Recovery Plan [NMFS 2009] and Recovery Plan for the Coterminous United States Population of Bull Trout [USFWS 2015], respectively) for ESA-listed species that include actions to address limiting factors.

Bull Trout

Of all the native salmonids in the Pacific Northwest of the United States, Bull Trout generally have the most specific habitat requirements (USFWS 2015). This includes cold water temperatures often less than 12 degrees Celsius, complex stream habitat including deep pools, overhanging banks and large woody debris, and connectivity between spawning and rearing (SR) areas and downstream foraging, migration, and overwintering (FMO) habitats. All populations of Bull Trout within the coterminous United States were listed as threatened by the USFWS in 1999.

Resident Bull Trout spend their life in the headwater streams, whereas migratory Bull Trout spawn and rear in the headwaters before migrating downstream to mainstem river habitats (Barrows et al. 2012). Both sub-adult and adult Bull Trout use the lower Walla Walla River during the fall, winter, and spring for rearing and overwintering (Barrows et al. 2012). Research by USFWS (2014) suggests that degraded habitat conditions in the lower Walla Walla River cause increase mortality in sub-adult and small adult size classes of migratory Bull Trout. Water quality factors limiting Bull Trout in the lower river include water temperatures and instream flows (USFWS 2015). Figure 3 illustrates Bull Trout use of the Lower Walla Walla River relative to temperature and discharge (CTUIR 2014). Improvement of the lower Walla Walla River migratory and foraging corridor has been indicated as a focus that would improve Bull Trout populations in the Walla Walla River (Schaller et al. 2014).

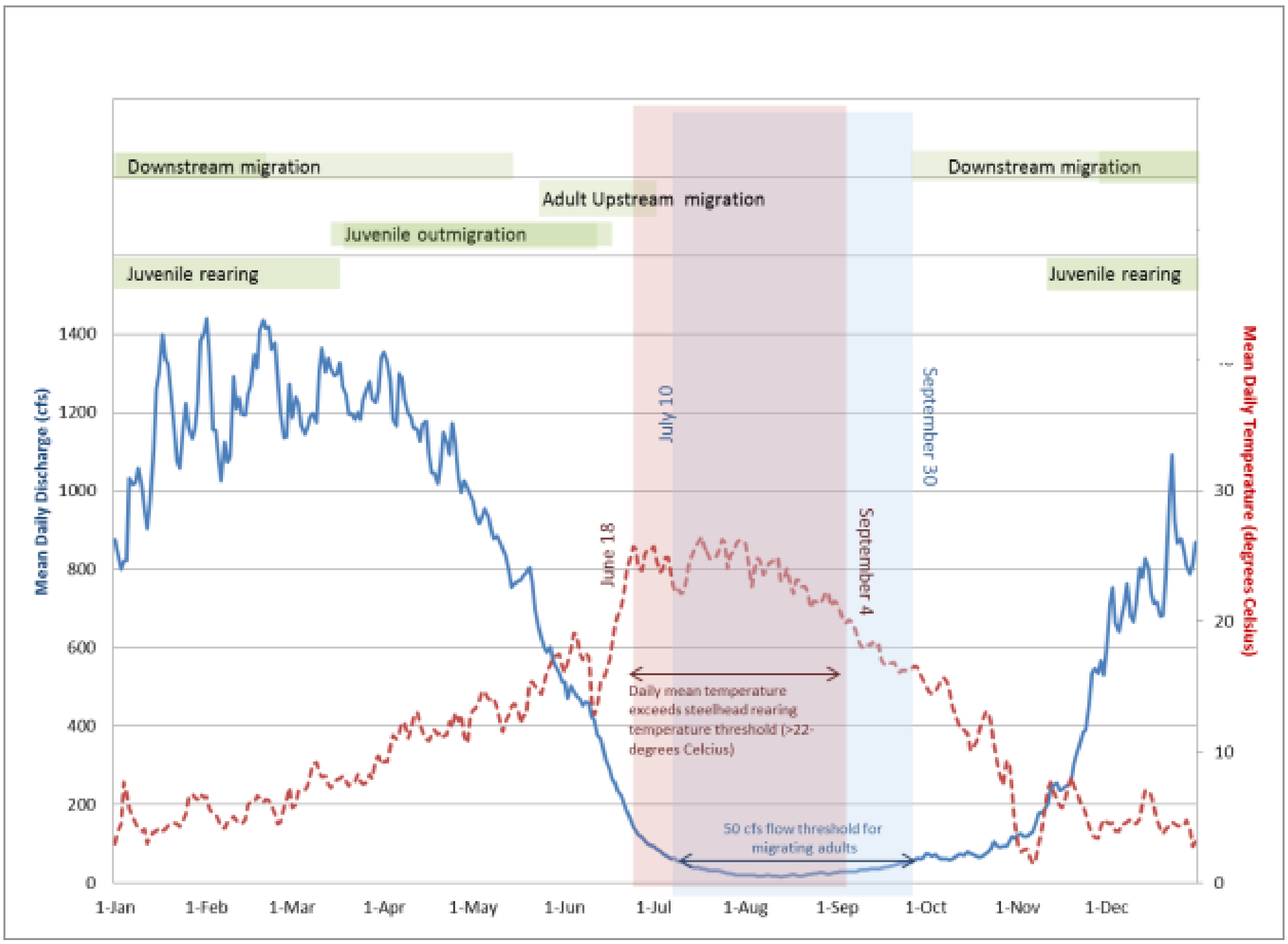

Figure 3. Bull Trout Use of the Lower Walla Walla River relative to discharge and temperature. Adapted from CTUIR (2014)

Steelhead

The Walla Walla River supports spawning populations of ESA-listed Middle Columbia River summer steelhead. In addition to the native summer steelhead, non-endemic and endemic hatchery steelhead have been released annually into the Touchet River and lower Walla Walla River as part of the Lower Snake River Compensation Program (Mendel et al. 2007). The majority of summer steelhead spawning and rearing occurs in the upper subwatersheds of the basin including the North and South Forks of the Walla Walla River, Mill Creek, and the North, South, and Wolf Forks of the Touchet River.

Research indicates juvenile steelhead migrate downstream to overwinter in the Lower Walla Walla River prior to outmigration, though summer rearing does not generally occur downstream of the confluence with Mill Creek (Mahoney et al. 2013). Survival estimates for juveniles that migrate from the upper Subbasin in the fall are lower than for those that migrate in the spring (Mahoney et al. 2011), indicating an overwintering loss in the Lower Walla Walla River. Survival estimates from the Upper Walla Walla River to McNary Dam indicate a substantial loss through the Lower Walla Walla River (Mahoney et al. 2011). Figure 4 illustrates steelhead use of the Lower Walla Walla River relative to temperature and discharge (CTUIR 2014).

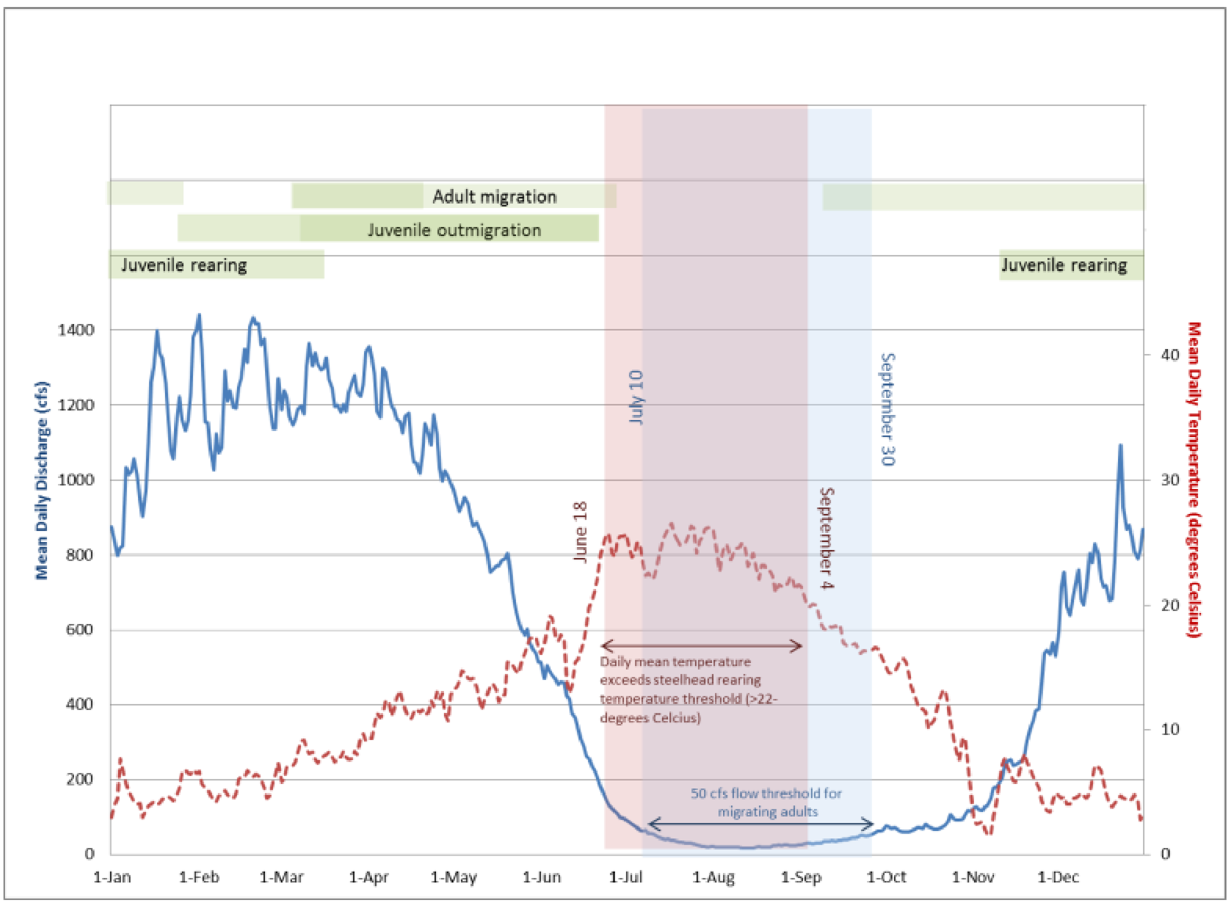

Figure 4. Steelhead Use of the Lower Walla Walla River relative to discharge and temperature. Adapted from CTUIR (2014).

ESA-listed Wildlife Species

Western Monarch Butterflies

Monarch butterflies (*Danaus plexippus*) are a large, conspicuous butterfly species that is listed as a Candidate species for protection under the ESA. Monarch butterflies occur in the United States as either resident or migratory populations. Migratory populations occur in temperate climates of western and eastern North America. Eastern populations migrate between breeding sites in temperate latitudes east of the Rocky Mountains to overwintering sites in Mexico, whereas western populations migrate between breeding sites in temperate latitudes west of the Rocky Mountains to overwintering sites on the central California coast. Monarch butterflies require milkweed (*Asclepias* spp.) as egg-laying sites and for larval development. The western population of monarch butterflies, while not genetically distinct from their eastern counterparts, have experienced population decline of over 90% over the past two decades. Monarch butterflies have been recorded using the McNary NWR Wallula Unit as recently as 2016 (Dilts et al. 2018).

Other species of interest

Spring Chinook Salmon

Spring Chinook salmon were extirpated from the Walla Walla Subbasin by the 1950s as a result of numerous factors, including historic passage barriers at nine-mile canyon, upstream of the project area. However, CTUIR initiated reintroduction efforts in the year 2000 and currently operates the South Fork Walla Walla River Hatchery to produce over 500,000 smolts per year that are released in the Walla Walla River and Mill Creek. The Washington Department of Fish and Wildlife releases an additional 150,000 spring Chinook Salmon smolts per year in the Touchet River subwatershed as part of the Lower Snake River Compensation Plan. This reintroduced stock is not listed under the ESA, but CTUIR is committed to achieving a sustainable population of naturally produced spring Chinook Salmon. CTUIR's Walla Walla Spring Chinook Monitoring and Evaluation Plan cites the need for "significant improvements in habitat", among other factors (CTUIR 2018: vii-ix). It is assumed that addressing limiting factors for Bull Trout and steelhead will improve conditions for spring Chinook. Figure 5 illustrates spring Chinook Salmon use of the Lower Walla Walla River relative to temperature and discharge (CTUIR 2014).

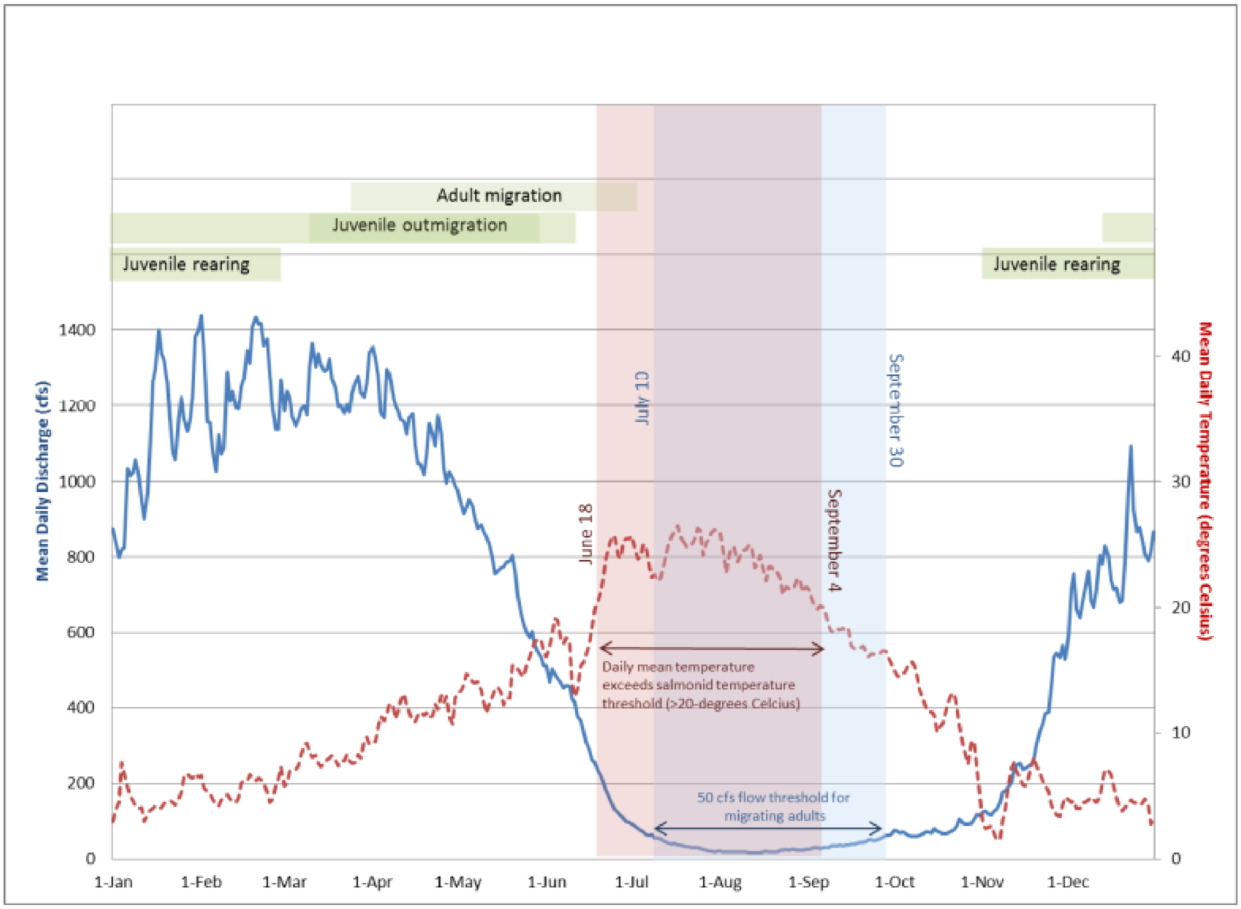

Figure 5. Spring Chinook salmon use of the Lower Walla Walla River relative to temperature and discharge. Adapted from (CTUIR 2014).

Similar to summer steelhead, spring Chinook Salmon juveniles often express a main-channel rearing life history where age-1 juveniles migrate from headwater rearing areas to mainstem habitats in the fall and overwinter prior to outmigration in the spring (Wydoski and Whitney 2003). Spring Chinook Salmon juveniles also experience high mortality rates in the lower Walla Walla River, with an average survival of natural origin spring Chinook Salmon juveniles from release to McNary Dam estimated at 25.9% (CTUIR, Robert Hogg, pers. comm, 2023; Figure 6).

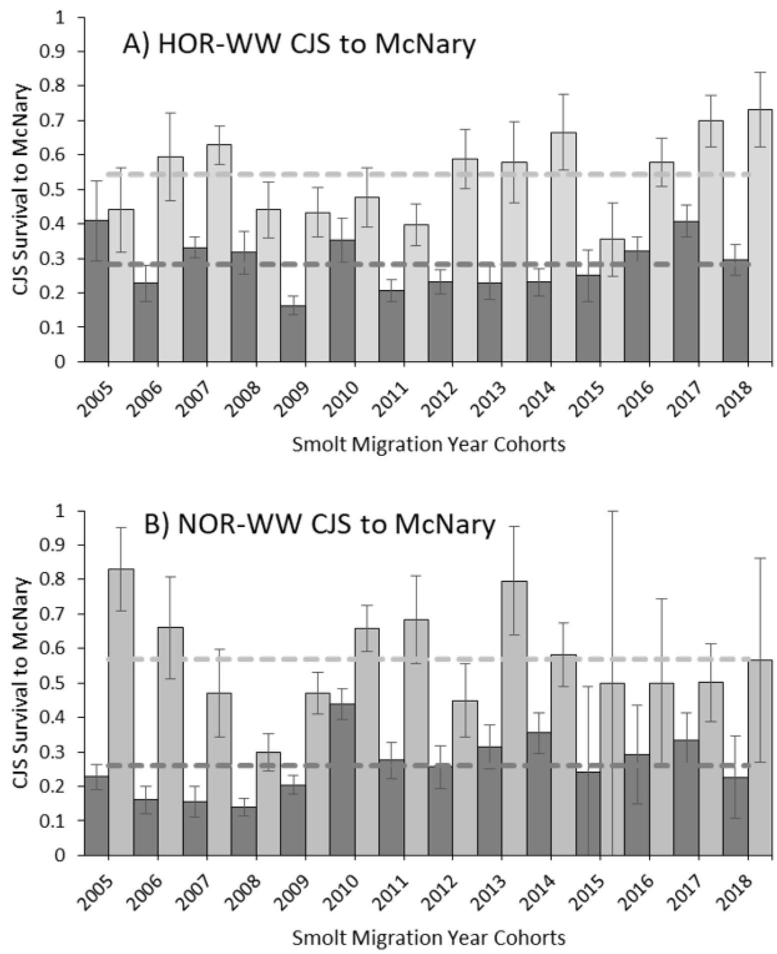

Figure 6. Comparisons of Cormack-Jolly-Seber (CJS) survival probability estimates calculated from uncensored (dark grey bars) and censored (light grey bars) datasets. (A) CJS survival estimates from release to McNary Dam for hatchery-origin smolts released from S. Fork Walla Walla River (HOR-WW), (B) CJS survival estimates from release to McNary Dam for natural-origin smolts released from the upper-Walla Walla River (NOR-WW).

Lamprey

Pacific lamprey (*Entosphenus tridentata*) is a federally listed species of concern that likely exists within the Walla Walla Subbasin (NPPC 2001). Pacific lamprey were historically abundant in the Walla Walla Subbasin, and were historically harvested by people of the CTUIR (NPPC 2001); however, current abundance and range are generally unknown but thought to be very limited (NWPCC 2005). Lamprey were collected in the 1960s, 1985, 1990, and between 1992 and 1995, but with no differentiation between Pacific and brook lamprey (NPPC 2001; NWPCC 2005). A 2003 study found no larval lamprey in the Walla Walla River (Moser and Close 2003). NRCS (2011) mentions sightings of Pacific lamprey in the Walla Walla River in the 2011.

CTUIR staff report no recent observations of Pacific lamprey within the Walla Walla, though they assume the species is likely present (CTUIR, Aaron Jackson, pers. comm. 2023). Translocation of Pacific Lamprey into the Walla Walla is included in the Master Plan with the first release expected in 2025 (CRITFC, 2018; CTUIR, Aaron Jackson, pers. comm. 2023)   According to CTUIR staff, the Walla Walla River has good habitat that Pacific lamprey can utilize and suitable water quality for larval lamprey survival, especially in the lower basin.

Freshwater Mussels

There are multiple species of freshwater mussels that are found locally. Adult mussels burrow into sediment and are often not an obvious presence, though they are vital to a healthy riverine ecosystem. Mussels are filter feeders, removing impurities and suspended solids from the water column. Freshwater mussels native to the Walla Walla River Basin rely on a native fish host for a portion of their life cycle, so impacts to their host fish species result in impacts to mussel reproduction (Blevins, 2018). Mussels require permanently inundated habitat with relatively stable substrate for burrowing. They are particularly sensitive to scouring flows, low dissolved oxygen, high temperatures, dewatering, and other disturbances (Xerces Society 2018).

There are significant multi-species populations of freshwater mussels within the project reach (CTUIR, Alexa Maine, pers. comm. 2022). Four species of *Anodonta spp.* are known to be present in dispersed, multi-age class, and reproductive populations (CTUIR pers. comm. 2022). Early assessment and planning will be utilized on this project to avoid impacts to these important populations.

Western ridged mussels (*Gonidea angulata*), while not known to occur within the project area, are a species of particular conservation concern.

Waterfowl

The Refuge is one of the most important wintering and migration stopover sites for mallards (*Anas platyrhynchos*) in the Pacific Flyway. In fact, the refuge receives hundreds of thousands of “duck use days” by mallards from November to March. The refuge is also an especially important migration location for northern pintail (*Anas acuta*), American wigeon (*Mareca americana*), green-winged teal (*Anas corolinensis*), northern shoveler (*Spatula clypeata*), canvasback (*Aythya valisineria*), greater scaup (*Aythya marila*), lesser scaup (*Aythya affinis*), ring-necked duck (*Aythya collaris*), bufflehead (*Bucephala albeola*), common goldeneye (*Bucephala clangula*), and ruddy duck (*Oxyura jamaicensis*). The Wallula Unit is one of the most important sites on the refuge for all of these species.

Restoring the connection between the Walla Walla River and its floodplain will be of particular benefit to waterfowl. As the river floods and recedes it will yield temporary pools of water in shallow depressions. These pools host a great abundance of insects, snails and other invertebrates not commonly found in more permanent waters. These invertebrates provide rich protein food resources exploited by waterfowl.

Neotropical Migrant Songbirds

The Wallula Unit provides high quality habitat for songbirds that nest in northern latitudes and winter in the tropics. Approximately 50 species of neotropical migrants use the Wallula Unit during migration as it is an oasis of green wetlands, willows, cottonwoods, and weedy areas in a sea of brown desert hills. The Unit also provides nesting habitat for an abundance of these species especially yellow warbler (*Setophaga petechial*), Bullock’s oriole (*Icterus bullockii*), black-headed grosbeak (*Pheucticus melanocephalus*), lazuli bunting (*Passerina amoena*), warbling vireo (*Vireo gilvus*), western wood pewee (*Contopus sordidulus*), and yellow-breasted chat (*Icteria virens*).

Restoring river channel complexity will benefit nesting and migrating neotropical songbirds substantially by regenerating willows and cottonwoods on newly formed sandbars. These sandbars are optimal for cottonwood and willow regeneration in riparian zones. Erosion and accretion of sandbars yields multiple successional stages and great structural diversity that is optimum for these birds.

Project Goals and Objectives

The goal of the initial contract is to produce conceptual designs that improve function of all 5 River Vision Touchstones to significantly improve fish and aquatic habitat while supporting restoration goals for wildlife and bird species. In developing the conceptual design, the contractor will focus on feasibility and phasing. The Partners will use the products from this initial contract to develop a plan for the Refuge and secure funding and support for the larger project.

The Partners believe that restoration activities will help to achieve the management goals in a more efficient and sustainable way. Many of the USFWS management goals center on providing high quality wetland and riparian habitat to support bird species. These are the same habitat types that CTUIR seeks to improve to support First Food species, including fish and plant species, by improving riverine processes. Many of the actions suggested in the Lower Walla Walla Geomorphic Assessment, such as beaver restoration, creation of off-channel habitat, and enhancement of riparian vegetation, will support the USFWS management goals as well as the CTUIR River Vision (Table 2).

Table 2. Alignment of goals outlined in guiding documents.

McNary NWR Goals	CTUIR Lower WW Assessment	CTUIR River Vision
Manage high-quality food and sanctuary to support large concentrations of migratory waterfowl	Riparian planting, beaver restoration, create off-channel habitat	Connectivity, Aquatic Biota,
Provide secure and productive foraging and nesting habitats for a diversity of shorebirds	Riparian planting, beaver restoration, create off-channel habitat	Connectivity, Riparian Vegetation, Aquatic Biota
Provide a diversity of high-quality wetland habitats for the benefit of migratory birds and other wetland plants and animals	Riparian planting, beaver restoration, create off-channel habitat	Geomorphology, Connectivity, Riparian Vegetation, Aquatic Biota
Provide high quality riparian habitats for the benefit of nesting and migrating birds, fish, riparian plants, and other riparian wildlife	Riparian planting, beaver restoration, create off-channel habitat	Connectivity, Riparian Vegetation
Contribute to the recovery of endangered, threatened, and sensitive species by protecting, maintaining, or increasing suitable habitats.	Riparian planting, remove invasive vegetation, beaver restoration, construct off-channel habitat, enhance in-stream habitat with large wood	Geomorphology, Connectivity, Riparian Vegetation, Aquatic Biota
Conserve and restore the plants, animals, and shrub steppe community representative of historic Columbia Basin Habitats	Riparian planting, remove invasive vegetation, beaver restoration, construct off-channel habitat, enhance in-stream habitat with large wood	Connectivity, riparian vegetation, aquatic biota

USFWS management goals extend beyond the floodplain and riverine habitat captured in CTUIR Lower Walla Walla River Assessment or CTUIR River Vision. The McNary NWR goals that are not directly correlated with goals in those two documents are:

- Protect the integrity of the biological resources of the river islands
- Protect and maintain the ecological integrity of talis, outcropping, and cliff habitats for natural levels of species diversity
- Visitors and local residents enjoy, value, learn about, and support the Refuges
- Hunters appreciate and experience a variety of quality hunting opportunities
- Anglers experience abundant opportunities to catch fish while appreciating the Refuges
- Students and teachers understand and value the Refuge System, and the ecology and management of McNary Wildlife Refuge
- Manage cultural resources for educational, scientific, and cultural benefits for the benefit of present and future generations of Refuge users and communities

Though not explicitly called out the two CTUIR documents from Table 2, these goals align directly with CTUIR's mission statements. The Fisheries Habitat Program operates under three mission statements, the Department of Natural Resources, then the Fisheries Department, then more specifically the Fisheries Habitat Program. The CTUIR mission statements are shown in Figure 7.

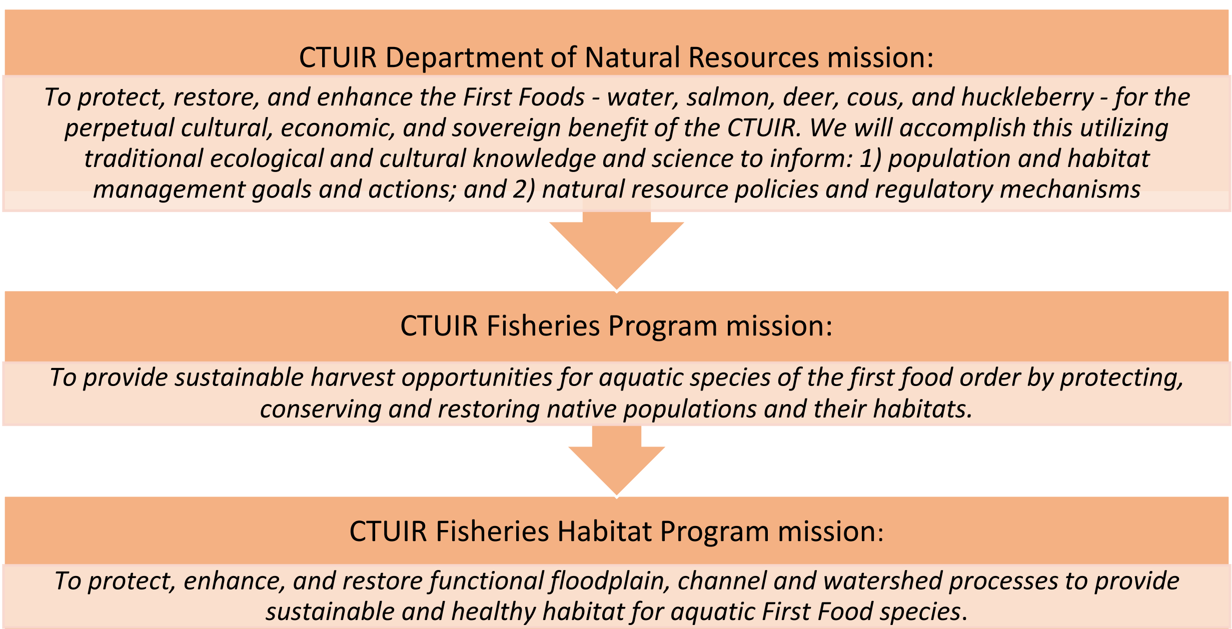

Figure 7. CTUIR mission statements in hierarchical order.

Objectives

Water Quality and Quantity

Raise floodplain water table to an average of 1 meters or less below floodplain surface between the months of July – October by 10 years after project completion

Floodplain water storage increases water availability to support floodplain forest development for fish and wildlife habitat. Woody riparian vegetation requires perennial water within the root zone of riparian obligate species like willow and cottonwood. Two meters below floodplain surface is near the absolute water table depth where cottonwood and willow seedlings have high mortality rates (Shafroth et al. 2000). The fine-grained sediment in the floodplain will likely increase the time required for floodplain saturation.

Geomorphology

Increase river complexity index to at least 25 at the 1250 cfs flow

River Complexity Index (Brown 2002) is a simple measure of sinuosity and braiding. Based on historic imagery from 1940 the River Complexity Index was 22.2 at low flow in the project reach, though the project area was already impacted by agricultural development at this time. Increasing river complexity will increase area and complexity for juvenile salmonid winter rearing as well as increasing migratory and holding habitat for returning adult salmonids (Swales et al. 1986).

Connectivity

Decrease floodplain activation flow to at least 1250 cfs

We define floodplain activation flow as the average annual 14-days duration flow, estimated to be approximately 1250 cfs in the project area. Similar to Williams et al (2009), we estimate this to be “the smallest flood pulse event that initiates substantial beneficial ecological processes associated with floodplain inundation.” Critical ecological processes supported by floodplain inundation includes recharging the alluvial aquifer, providing water and suitable substrate for floodplain vegetation, providing larger and more diverse off-channel habitat annually for focal fish species to rear and enhance growth, and providing seasonal wetland habitat annually for migratory wildlife species (reviewed in Opperman et al. 2017).

Increase Expected Annual Habitat by at least 25%

Expected Annual Habitat (EAH) is a measure of both area inundated and duration of inundation developed by Matella and Jagt (2014). EAH estimates the long-term statistical average quantity of habitat expected under a given design scenario over a range of flood probabilities. 25% of the floodplain area equates to approximately 200 acres, excluding Sanctuary Pond and the Woodland and Millet Ponds.

Riparian Vegetation

Plant site-appropriate native riparian vegetation on at least of 200 acres of floodplain

Revegetation of the disconnected floodplain with site appropriate riparian vegetation is intended to provide services including stream shading, contributing to channel complexity, and providing nesting and migratory habitat for important wildlife species (Skagen et al. 2005). Riparian communities that are especially important for fish and wildlife uplift include black cottonwood-dominant plant associations and willow-dominant plant associations.

Plant at least 25 acres of site-appropriate First Foods species

Abundant and harvestable First Foods are critical for continuity of Tribal culture. Degraded floodplain habitats have decreased the abundance and availability of many wetland First Foods and culturally important species including wapato (*Sagittaria* spp.), dogbane hemp (*Apocynum cannabinum*), and chokecherry (*Prunus virginiana;* Hunn 2015). Increasing abundance of these and other species will enhance opportunities for Tribal members to exercise treaty rights.

Remove at least 25 acres of invasive riparian vegetation

Invasive riparian vegetation tends to outcompete desirable native plant communities, reduce biodiversity, decrease wildlife habitat, and may increase erosion potential. Removal of invasive riparian vegetation and conversion to native plant communities is desired to enhance the ecosystem services provides by those communities.

Aquatic Biota

Increase suitable winter rearing habitat for spring Chinook Salmon and summer steelhead at the 1250 cfs flow by at least 150%

The project area will primarily be used by focal fish species between the months of November – June when water temperatures are appropriate for rearing and migration. For winter rearing, focal fish species require complex, connected, off-channel habitats including side channels, connected wetlands, backwaters, alcoves, and other habitat types that support preferential flow and depth conditions for optimal growth (Allen 2000). In general, salmonid winter rearing habitat should target water column depths of 1-4 feet with an average water column velocity of 0 – 1.75 feet per second.

Wildlife

Increase seasonally inundated wetland habitat by at least 100 acres

Seasonally inundated wetlands, also known as moist soil areas, are areas that are flooded in the fall and winter and dry in the summer. These habitats provide key ecological services for waterfowl including food production and cover. These habitats also support a variety of shorebirds and wading birds. Seasonally inundated wetlands created should be self-sustaining and function without the need for water control infrastructure (e.g. dikes, headgates, pumps, etc.)

Increase shallow marsh habitat by at least 15 acres

Shallow marsh habitats consist of persistent open water wetlands with less than 50% cover of tall persistent emergent vegetation. Creation of shallow marsh habitats is intended to mimic natural disturbance regimes that maintain the cyclical aging and renewal processes of wetlands over time that have been altered by hydrologic management and fluvial process degradation. These habitats are critical for use by waterfowl and other water birds.

Increase suitable tree-dominated nesting habitat by at least 50 acres by 20 years after project completion

Well-structured, tree-dominated riparian habitats (e.g. cottonwood, alder, tree-type willow) are key for nesting success of native migratory passerine birds such as yellow warbler and Bullock's oriole (Altman and Holmes 2000)**.** Conditions and processes supporting tree-dominated habitat should be self-sustaining.

Increase suitable shrub-dominated nesting habitat by at least 50 acres by 20 years after project completion

Shrub-dominated riparian habitats with variable patch sizes and canopy densities are required for nesting success of native migratory passerine birds such as lazuli bunting and willow flycatcher (*Empidonax traillii*; Altman and Holmes 2000). Conditions and processes supporting shrub-dominated habitat should be self-sustaining.

Outreach, Access, and Recreation

Maintain boating safety in the main channel of the Walla Walla River

Recreational boaters utilize the Walla Walla River for fishing, hunting, birdwatching, and pleasure cruising. The lower Walla Walla River is listed as a navigable water of the United States, regulated under Section 10 of the Rivers and Harbors Act of 1899, from the original confluence with the Columbia River upstream to the head of navigation at the US Highway 12 bridge, approximately 10 miles upstream of the current confluence with the McNary Dam pool.

Enhance interpretive signage

Interpretive signage at access points and along trails, such as the Wallula Horse Trail, will educate Refuge visitors about the various riverine, floodplain, wetland, lacustrine, and upland habitats present on the Wallula Unit and the numerous species they support. Signage should highlight the restoration efforts and the diversity of habitats and fish and wildlife species that utilize them.

Existing Conditions and Assessment

The Lower Walla Walla River is a low-gradient, primarily single-channel system, which passes almost entirely through agricultural areas. In the project reach, the channel is a very low gradient (0.0004 foot/foot), single-thread, and relatively straight for most of its length (sinuosity of 1.2). The historic floodplain in the lower half of the reach is broad (average of over 2,000 feet) and flat, and contains several connected waterbodies and wetlands including Sanctuary Pond and Whitetail Bay. The presence of a riparian canopy is relatively lacking or sparse, with the riparian zone comprising mostly understory and groundcover vegetation mixed with patches of invasive riparian species including false indigo and Russian olive.

Relative to historical conditions, the Walla Walla River has been highly simplified, straightened, restricted from historical floodplains, and impacted by irrigation withdrawals (Figure 7). CTUIR biologists report high mortalities in out-migrating fish in the lower river due to several limiting factors. 10-year average survival for naturally produced Steelhead emigrants is 23%, naturally produced spring Chinook salmon is 34%, and hatchery spring Chinook salmon is 27% (CTUIR, Robert Hogg, pers. comm., 2023). The majority of the fish that are produced in the high-quality habitat of the upper subbasin don't survive the migration to the mainstem Columbia River, which impacts the effectiveness of upper subbasin habitat restoration. Physical and physiological limiting factors in the Lower Walla Walla River include water quantity, quality, and temperature, along with biological factors such as predation.

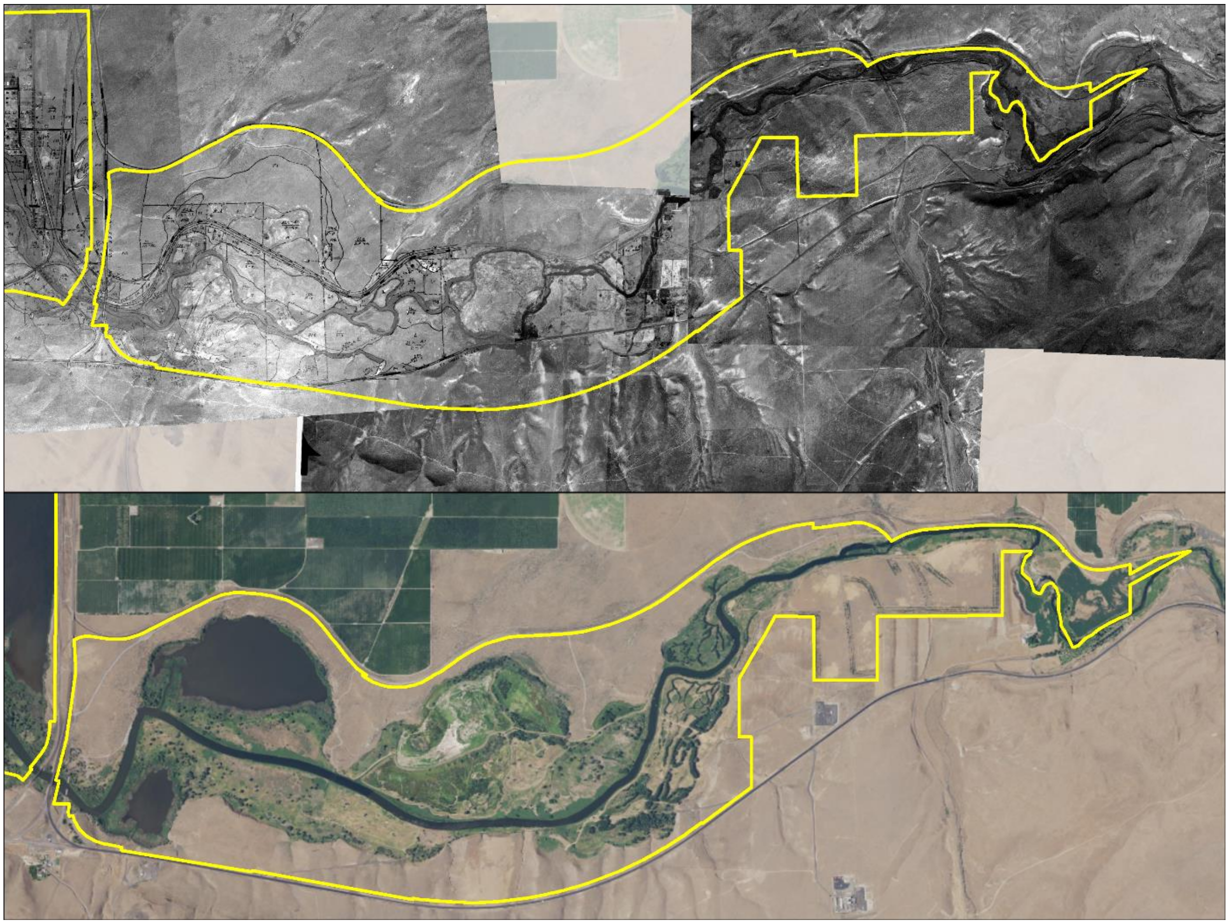

Figure 8. Historic imagery from circa 1940 (top) compared to recent imagery circa 2020 demonstrating loss of channel complexity.

Native fish assemblages in the Walla Walla River Subbasin have evolved to thrive in a system of cold and clean water, complex and dynamic lotic habitats, dense riparian communities, and ecological connectivity between the aquatic and terrestrial environment (floodplains). Direct and indirect impacts from anthropogenic alterations to the Lower Walla Walla River over the past century have negatively affected water quantity and quality, as well as the quantity and quality of remaining fish habitat.

The GAAP analysis completed by CTUIR in 2014 summarizes existing conditions in the lower Walla Walla River. The McNary Refuge falls within Reach 1 identified in the GAAP analysis. Geomorphic Reach 1 extends from the confluence with the Columbia River near Wallula Junction to RM 8.6 located upstream of Zangar Junction. Historically, the mouth of the Walla Walla extended several miles into what is now the Columbia River; however, the creation of Lake Wallula behind McNary Dam in 1958 inundated miles of the channel and floodplain at the mouth. The backwater effect from McNary Dam extends as far as RM 9 and 10 at certain times of the year. The current river mouth is near RM 3.6 with a delta that extends into Lake Wallula to approximately RM 3.0. The following sections summarize data for Reach 1 in relation to the five River Vision Touchstones.

Water quality and quantity

Detailed descriptions of the hydrology of the Walla Walla River can be found in the Walla Walla Subbasin Plan (NWPCC 2005) and the Lower Walla Walla River Geomorphic Assessment and Action Plan (CTUIR 2014).

Flows in the Walla Walla River can be divided into three main sources: precipitation runoff (dominating flows in early winter), snowmelt runoff (contributing substantial flow in spring and early summer), and groundwater discharge (supplying flows during summer and colder times in winter). Peak flows generally occur in the Walla Walla River with winter rains and spring snowmelt. Low flow periods generally occur between July and October, with average annual high flows peaking between January and April (Figure 8).

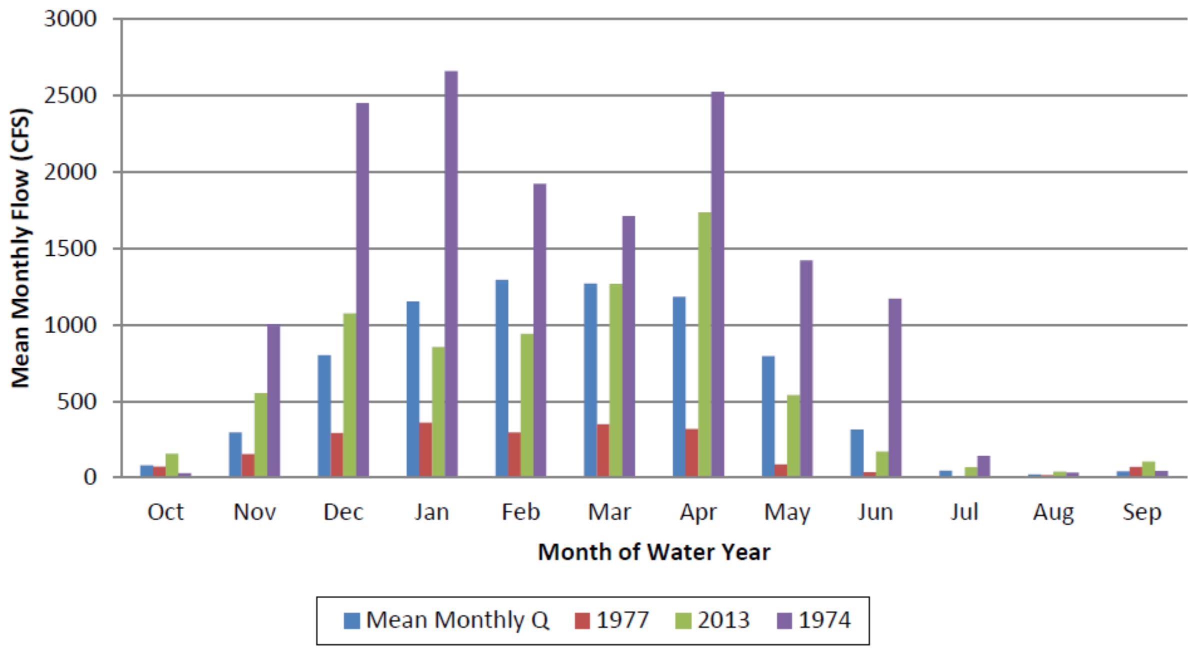

Figure 9. Mean monthly flows from USGS gage 14018500 on the Walla Walla River near Touchet, Washington. Mean flows included for overall mean as well as representative years for drought (1977), average (2013), and wet (1974) precipitation conditions. Adapted from CTUIR 2014.

The Walla Walla River has been 303(d) listed for temperature, flow, pesticides, pH, dissolved oxygen, and fecal coliform bacteria (NPPC 2001, ODEQ 2005, NWPCC 2005, WWWPU 2005, WDOE 2006, WDOE 2014). TMDLs exist for temperature, pesticides, pH, bacteria, and dissolved oxygen and are actively being implemented (ODEQ 2005, WDOE 2006). In the lower Walla Walla River, sedimentation, temperature, and low flow quantity have been identified as the primary water quality factors limiting steelhead production (NWPCC 2005, NMFS 2009, SRSRB 2011). Water quality factors limiting Bull Trout production include water temperatures and instream flows (USFWS 2015).

The Walla Walla River has not been 303(d) listed for suspended solids or turbidity, but total suspended solids concentration from January to June in the Walla Walla River have been reported between 50 – 650 milligrams per liter (mg/L; CTUIR 2014). Fine sediments in the Walla Walla River result primarily from agricultural practices, as well as urban runoff, road building and logging in the upper subbasin, and recreational vehicle use (WDOE 2006).

Geomorphology

The Walla Walla River through project area is deeply incised. Bank and floodplain materials consist of fine sediments deposited by a sequence of glacial outburst floods (Touchet beds) and aeolian processes (windblown loess soils). These sediments are readily transported by the Walla Walla River and not likely a source of significant aggradation (CTUIR 2014). Bankfull and wetted widths in the project area are wide compared to upstream reaches of the lower Walla Walla River (CTUIR 2014).

The results of the channel morphology assessment identified the metrics listed in Table 3 for Reach 1. Longitudinal variations of metrics are displayed graphically in Figures 3-8, 3-9 and 3-10 of the GAAP analysis.

Table 3. Channel morphology metrics for the project reach. Adapted from CTUIR 2014 (1) and remote sensing data (2).

Metric	Reach 1 (RM 3.6-8.6)
Bankfull Width (ft)[1]	154
Wetted Width (ft)[1]	143
Bankfull Depth (ft)[1]	9.1
Gradient (ft/ft)[1]	0.0004
Width/Depth Ratio[1]	17
Incision Width (ft)[1]	151
Incision Depth (ft)[1]	16
Entrenchment Ratio[1]	9.2
Channel Pattern[1]	Straight
Islands[1]	Occasional
Bar Type[1]	Side; Diagonal
Migration[1]	Lateral
Rosgen Classification[1]	C6c/F6
Sinuosity[2]	1.17
Valley Width (ft)[1]	2,405
Meander belt width 1939-2013 (ft)[1]	994
Average Channel Migration Rate (ft/yr)[1]	1.7
Maximum Channel Migration Rate (ft/yr)[1]	8
Braided-channel Ratio[1]	1.0
River Complexity Index[2]	5.85

Geomorphic function throughout much of the project area is likely impacted by backwater effects from McNary Dam pool.

Connectivity

The lower Walla Walla River is deeply incised through the project area. The project reach was determined to be Stage 2 in the Stream Evolution Model (SEM; Cluer and Thorne 2014), which has the lowest level of hydrogeomorphic and habitat and ecosystem benefits because it is highly modified and simplified. Although there is some lateral activity, there is no inset floodplain. One of the main factors for relatively low hydrogeomorphic attributes in Stage 2 channels is the lack of floodplain connectivity due to high bank heights in relation to flood stage heights. The reach may progress to higher SEM stages at a slow rate if actions are not taken and disturbances removed or more quickly if more active restoration approaches are employed (CTUIR 2014).

Hydraulic modeling was completed for the GAAP analysis using peak flow data from the USGS gage near Touchet, Washington (USGS stream gage 14018500). Table 4 summarizes the estimated inundation widths for each design flow. A figure displaying inundation boundaries is included in Appendix C of the GAAP.

Table 4. Average estimated Inundation Widths for Reach 1 utilizing USGS 10-arc second DEM topographic data

Recurrence Interval	Average Inundation Width in Reach 1 (ft)
2-year	398
5-year	1,323
10-year	1,490
100-year	1,885

Primary causes of lack of floodplain connectivity includes altered channel hydraulic function, channel incision, and laterally confining dikes.

Riparian vegetation

Native riparian and floodplain vegetation is limited in the Refuge, likely due to the incised stream, lowered water table, and lack of floodplain inundation. Current riparian vegetation is composed largely of tall nonnative grasses and occasional thickets of willows (*Salix spp.*) or false indigo bush (*Amorpha fruticosa*). The majority of the riparian vegetation in the project area is rated as poor, according to a recent analysis by CTUIR using the Riparian Condition Assessment Tool (Macfarlane et al. 2018). Factors influencing the loss of native riparian vegetation included conversion to agriculture, conversion to introduced vegetation, development, and conversion to grassland/shrubland (Figure 9).

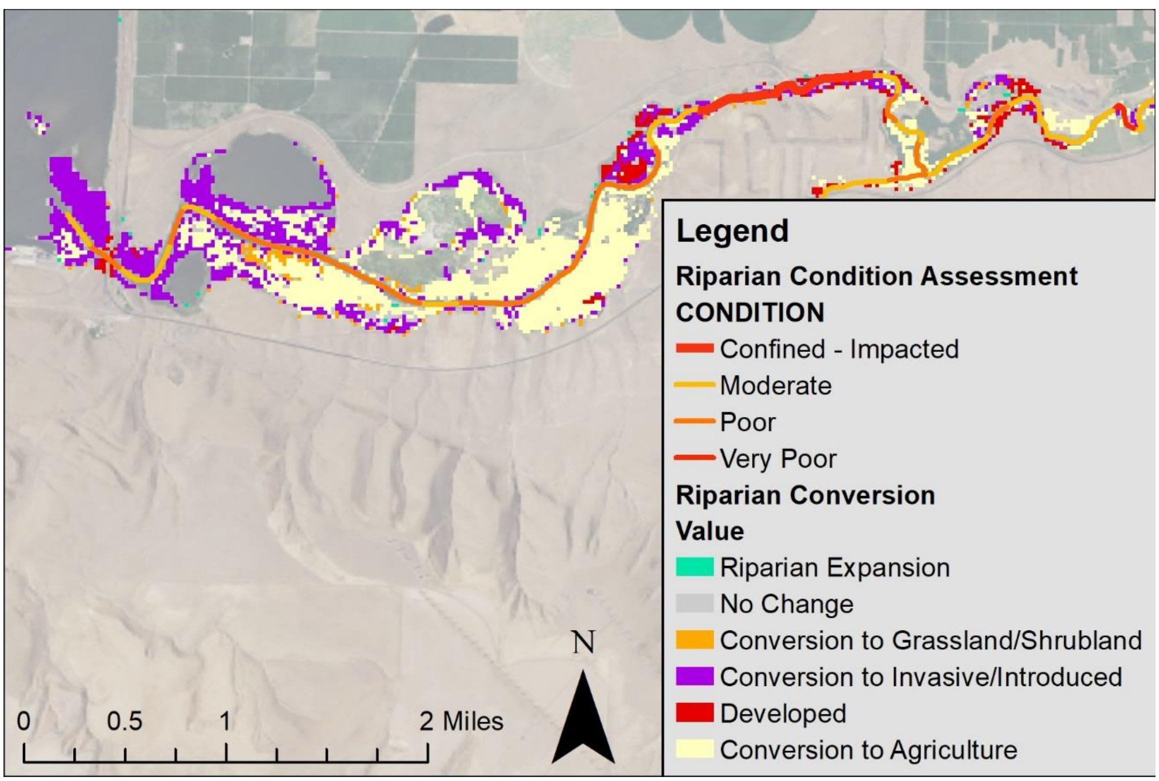

Figure 10. Results from an implementation of the Riparian Condition Assessment Tool (RCAT) describing modelled riparian condition and sources of native riparian vegetation loss across the project area.

Historic land use in the project area resulted in the removal of most of the floodplain vegetation prior to the acquisition of the Refuge by USFWS. Anthropogenic land uses have led to the introduction of numerous invasive plants including cheatgrass (*Bromus tectorum*), Russian thistle (*Kali tragus*), yellow star-thistle

(*Centaurea solstitialis*), Russian olive (*Eleagnus angustifolia*), black locust (*Robinia pseudoacacia*), false indigo bush, and reed canarygrass (*Phalaris arundinacea*). Native vegetation, where present, consists of black cottonwood (*Populus trichocarpa*) and various willow species.

The Refuge staff have successfully planted cottonwood species in the past in several locations where plantings could access the water table. Natural recruitment of cottonwoods and other native species is sparse.

Aquatic biota

The majority of the habitat in the Lower Walla Walla River is characterized during winter flows as fast non-turbulent habitat punctuated by short fast turbulent segments where flows are diverted or coarse substrates are present. Table 5 summarizes fish habitat characteristics in Reach 1 as identified in the 2014 GAAP.

Table 5. Summary of Fish Habitat Characteristics in Reach 1

Metric	Reach 1 (RM 3.6-8.6)
Pool to pool spacing (ft)	1,132
Maximum pool depth (ft)	17
Percent pools (%)	7
LWD Quantity (jams/mi)	0
Presence of Bars	None
Presence of islands	Occasional
Secondary and off-channel habitat (ft)	5,911

Focal fish species utilization and limiting factors within the project reach were evaluated primarily based on spring Chinook Salmon and steelhead. Bull Trout use and associated limiting factors are largely unknown and considered a data gap requiring further studies. Fall Chinook and Coho Salmon have been observed spawning or reported as juveniles in the Lower Walla Walla River, though very limited information is available on their utilization. Adult spring Chinook Salmon and steelhead are known to migrate upstream through the Lower Walla Walla River to access upstream tributaries and spawning areas. Supporting conditions of migration habitat include in-channel and edge refuge features. The primary limiting factors affecting migrating spring Chinook salmon and steelhead include pool frequency, pool depth and large woody debris structure.

Spring Chinook Salmon and steelhead are believed to use all available rearing habitat between the upper portions of the Subbasin spawning areas and the Lower Walla Walla River mouth. Juvenile spring Chinook Salmon and steelhead exhibit bimodal migratory timing in their life-history in the Walla Walla River, with a portion of the population migrating to the lower portions of the subbasin in the fall and overwintering until outmigration in the spring. Supporting conditions for winter rearing use includes edge habitats, slower water, cover (safety from predators), and food source. The primary limiting factors affecting rearing habitat include streambank condition, off-channel habitat, flood refugia, LWD, and pool frequency.

The primary outmigration of juvenile spring Chinook Salmon and steelhead is known to occur in the spring and early summer. Juvenile salmonids migrate from rearing and overwintering habitat higher in the subbasin and pass through the lower Walla Walla River in transit to the Columbia River and the Pacific Ocean. Supporting conditions for outmigration habitat include cover from predators (terrestrial and aquatic), resting areas, and food sources mostly along stream edges. Primary limiting factors for outmigration habitat include riparian condition, streambank condition, floodplain connectivity, high flow refugia, LWD, and off-channel habitat.

Refuge Management for Wildlife Species

Habitat management in the Wallula Unit is especially concentrated on controlling water levels in four wetland units that total approximately 350 acres. The water management capacity is facilitated by important infrastructure including dikes, water control structures, irrigation canals, pumps and water diversion sites. Water management is designed to mimic the seasonal wetlands that were historically driven by Walla Walla River flooding and subsequent water subsidence. These historic wetlands were lost due to adjacent land use patterns. Seasonal wetlands are especially important to wildlife because of their absence on the landscape because they are typically the first wetlands to be drained. The refuge's water level management yields diverse wetland plant communities, open water, and mudflats that are vitally important to waterfowl, shorebirds, wading birds, songbirds, reptiles, amphibians, and innumerable other forms of wetland wildlife.

Refuge management in the Wallula Unit also includes extensive invasive species control. *Phragmites*, Russian olive, and saltcedar are particularly problematic species where control efforts are concentrated. False-indigo, purple loosestrife, yellowflag iris, and joint grass also degrade wildlife habitat. Cottonwood stand regeneration has also been a refuge management focus. Miles of cottonwood stands have been created, many replacing stands that were lost to wildfires. These stands are especially important for nesting and migrant songbirds.

Desired Future Conditions

The goal of this project is to identify and develop opportunities to encourage restoration of river processes, reconnect floodplain, increase channel complexity, and improve riparian vegetation.

Water quality and quantity

The project design is unlikely to have a major impact on the greatest water quality limiting factors, but may be able to impact factors such as temperature diversity and turbidity. Increased complexity through the project reach with associated the creation of pools and increased floodplain and side channel connectivity is expected to provide more pockets of cool water to benefit fish species.

As flow restoration efforts continue in the Walla Walla River, the design should incorporate current water management regime and desired future flows to ensure compatibility with future conditions (Table 6).

Table 6. Prescribed minimum flows for the Lower Walla Walla River in cubic feet per second to support ecological function. Adapted from CTUIR (2013).

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept
190	237	268	320	398	561	735	529	313	183	163	170

Geomorphology

The project design should create complex, self-sustaining habitats suitable for target fish and wildlife species. Restoration actions that restore geomorphic processes and improve in-channel habitat complexity, midchannel island formation, and off-channel habitat creation are preferred. The floodplain in the project area should have complex topography that inundates with floodwaters at a variety of flows to provide diverse depth and velocity conditions across the annual hydrograph. Additionally, the design should incorporate likely climate change scenarios and create resilient design features that continue to achieve project goals and objectives under a changing hydrologic setting.

Connectivity

The project design should improve connectivity of the river to its floodplain, including annual inundation and soil saturation. The design should create self-sustained seasonal wetlands that provide slow water refugia for target fish and wildlife species at biologically important times. Improving floodplain connectivity will improve many other ecosystem services associated with floodplain functionality including hyporheic exchange, natural cottonwood and native vegetation recruitment, raising the water table for riparian vegetation development, and providing seasonally inundated wetlands to provide key habitats for waterfowl and shorebirds.

Riparian Vegetation

The design will result in improved riparian conditions through planting as well as improved lateral and vertical connectivity. More areas of saturated soils will allow for better recruitment and development of cottonwood and willow populations. Improvements to the riparian condition will increase shading on stream channel and increase natural recruitment of large wood to stream channel. Improved and expanded riparian plant communities will also enhance suitable nesting habitat for migratory passerine bids.

The project will also increase suitable habitats and abundance of important First Foods and culturally significant plant species including, but not limited to, tule (*Schoenoplectus acutus*), wapato, dogbane hemp, chokecherry (*Prunus virginiana*), and elderberry (*Sambucus cerulea*).

Aquatic biota

Improvements to the functions of the other River Vision touchstones are expected to improve conditions for aquatic biota. Increased complexity and connectivity will increase rearing and overwintering habitat for salmonids. Beaver restoration will include the creation of side channel habitats and increased riparian forage. Creation of side channels should encourage dam building in the population of beavers located in the refuge.

Project Considerations and Risks

Climate Change

Climate change is perhaps the greatest threat to the viability of steelhead and salmon populations in the Columbia River basin (Figure 11). In the interior Pacific Northwest, climate change is anticipated to produce warmer conditions throughout the year and a reduction of annual snowpack (Mote et al. 2003; Clifton et al. 2018). Those changed conditions will lead to changes in the ecological conditions of the aquatic habitats utilized by native aquatic biota including increased magnitude of fall and spring flow events, decreased summer baseflow quantity, and increased summer water temperatures (Isaak et al. 2017a; Clifton et al. 2018; Queen et al. 2021).

	S0	S1	S2	S3	S4
AC0					
AC1					• Chinook Salmon
AC2				• Cous • Elk • Agriculture (Non-irrigated crops)	
AC3				• Huckleberry • Wildfires	• Agriculture (Irrigated crops) • Water (long-term) • Flooding
AC4	• Water (short-term)	• Vector-borne diseases • Population dynamics	• Increases in crime • Heat waves		

Figure 11. Climate change vulnerability rankings of key items of concern for the CTUIR based on sensitivity to climate change (X axis) and adaptive capacity (Y axis). Vulnerability increases from bottom left to top right of the figure. Adapted from CTUIR (2015).

In the Walla Walla subbasin, it is anticipated that summer stream temperatures will increase by 2-10 degrees Fahrenheit by 2080 (CTUIR 2015), mountain snowpack will decrease by an average of 6-14 in SWE in April (Hegewisch et al. 2021), and summer baseflow will decrease by an average 35% in the major spawning and rearing areas of the subbasin (Figure 12). Summer baseflow in predicted to decrease by 6.24 cfs in the upper North Fork Touchet River, 8.86 cfs in upper Mill Creek, and 29.78 cfs in the Walla Walla River near the confluence of the North and South Fork by 2080 (Wenger et al. 2010). The CTUIR GIS department has summarized anticipated climate change impacts across the CTUIR ceded area.

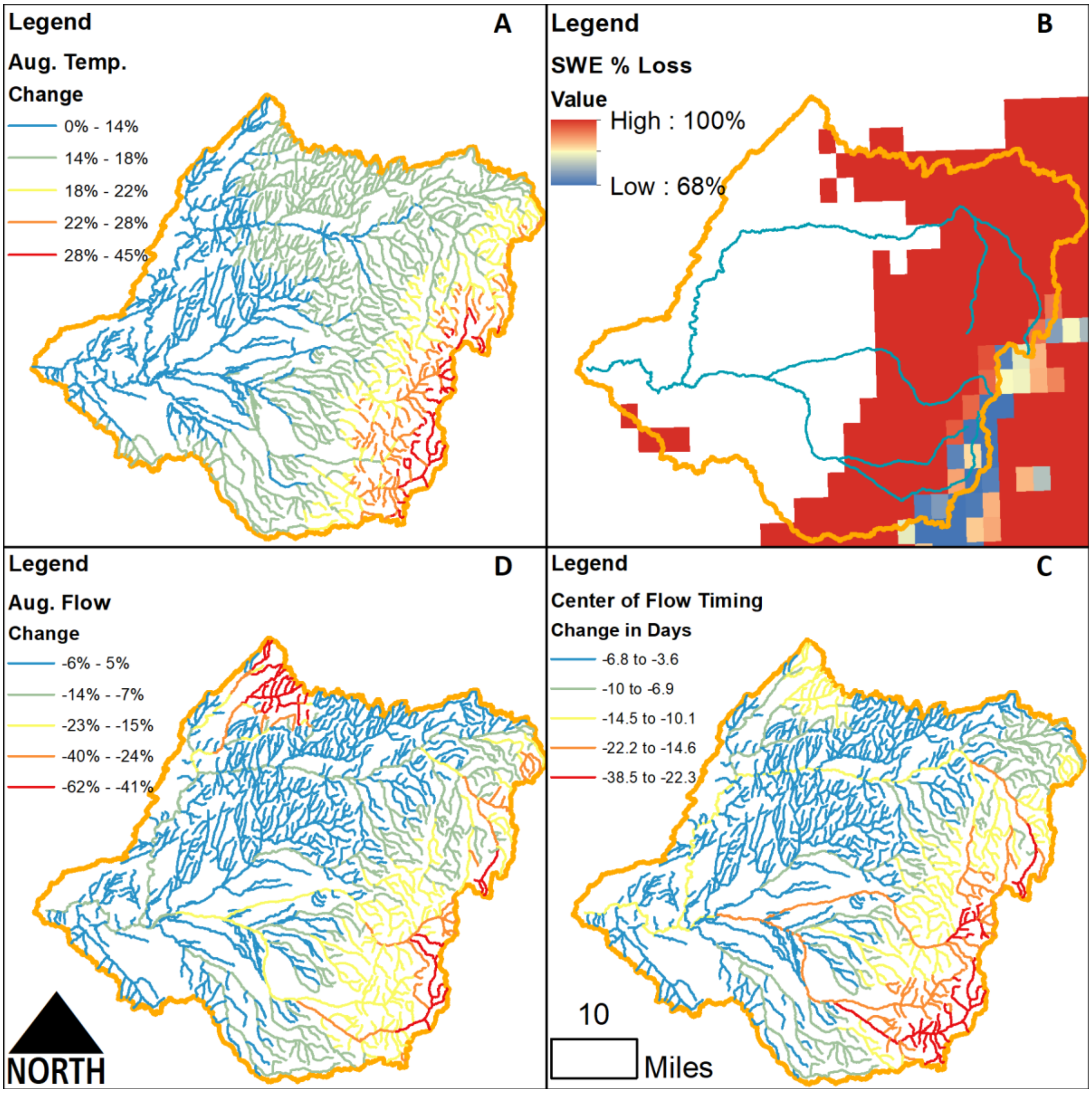

Figure 12. Clockwise from the top left quadrant A) percent change in August stream temperature between historic and modelled 2080 conditions under the A1B climate scenario; B) percent change in peak snow water equivalent between historic and modelled 2080 conditions under the A1B climate scenario; C) change in the center of flow timing in water year days anticipated by 2080 under the A1B climate scenario; D) percent change in August flow conditions between historic and modelled 2080 conditions under the A1B climate scenario.

Changing climate conditions have the potential to reduce the quantity of habitat suitable for spawning and rearing of native fish species, influence survival of all life stages of fish, and reduce overall productivity of native fish populations (Wade et al. 2013; Isaak et al. 2017b). These changes in climate are driven by global factors not easily influenced by local actions and are unlikely to be reversed. In addition to the need for action to slow climate change on a global scale, actions to restore functional watershed processes are needed to increase resiliency of aquatic habitats to the effects of climate change (Beechie et al. 2013; Justice et al. 2017).

McNary Dam Pool

A major project consideration is how to design for processed based restoration in a reach that has altered hydrology from McNary Dam. Not all historic processes can be realized in this reach with the backwater effects from the dam (Figure 10). How do we improve the geomorphic conditions? Can these backwater effects be used to our advantage by acting as a downstream control for the design?

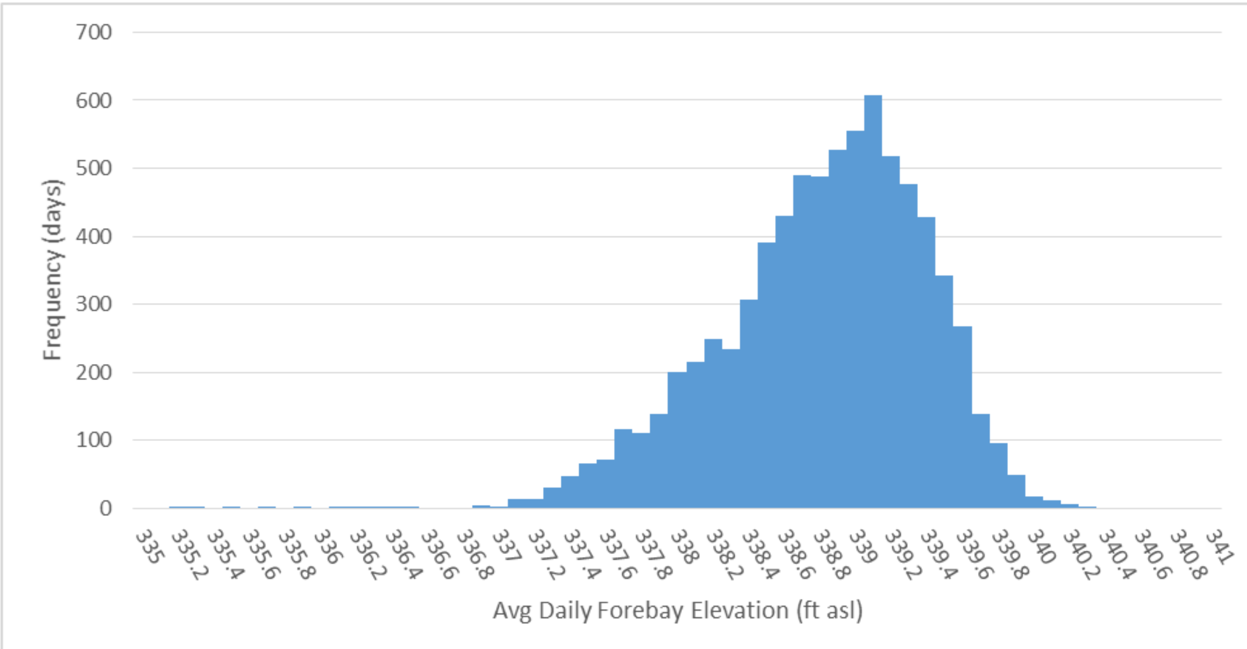

Figure 13. Distribution of mean daily forebay elevation of the McNary Dam Pool between 2000 – 2020.

Construction Feasibility

The design alternatives should be feasible within the framework and priorities that each agency is constrained by while still achieving restoration objectives. Funding for future phases of the project will be sought from various avenues, including the salmon recovery dollars already obtained. The conceptual design should consider the scope and phasing of actions, accounting for the scale of the site. Construction is likely to happen in phases. These phasing should be considered in the conceptual design.

Cultural Resources

The project reach is rich with cultural resources. The Partners are interfacing with the CTUIR Cultural Resources Protection Program (CRPP) early in order to avoid impacts to cultural resources. The selected contractor will be informed of measures they are expected to take in the design to protect such resources.

McNary National Wildlife Refuge infrastructure

The Wallula Unit contains an abundance of critical infrastructure and facilities that support habitat management, visitor services, general refuge operations, and utility maintenance; including approximately twelve miles of public access roads, twelve parking areas, four miles of dikes, six water control structures, ten miles of trails, one boat launch, three pump sites, one mile of irrigation canal, five miles of utility easements, and 15 waterfowl hunting blinds. Some of these facilities, such as dikes and water control structures, may be modified to improve floodplain and channel function and improve habitat quality for fish and wildlife. Careful consideration must be taken to ensure continued operation of the Refuge for the public and alignment with the CCP management directives and goals.

Private infrastructure protection

The scope of work for the Conceptual design includes tasks for Site Assessment and Survey. During these tasks, the contractor will identify and locate public and private infrastructure within the project reach. Some data will be provided by the Partners, but it is not exhaustive. Infrastructure known to be present includes pipelines including natural gas, powerlines, roadways, water control structures, irrigation points of diversion (Figure 1).

Public interface

Several user groups are known to utilize the Refuge including; hunting interest groups, fishing interest groups, boating interest groups, birding interest groups, educational interest groups, and conservation interest groups. The project design will consider opportunities to enhance the user experience for all of these groups and will provide new education and outreach opportunities.

Public safety

The project reach is a publicly accessible site and is bordered on two sides by US Highway 12, and therefore public safety is of great concern to the Partners. The design should ensure project actions won't pose an unacceptable risk to public safety. This portion of the Walla Walla River is used by several user groups, including recreational boaters. Public access and safety should be considered during every level of design.

Negative ecological interactions

A known data gap in our understanding of the causal factors resulting in poor juvenile salmonid survival in the lower Walla Walla River includes negative interactions between winter rearing and outmigrating juvenile salmonids and predatory and/or competitive interaction with introduced fish species, including smallmouth bass (*Micropterus dolomieu*). The design should consider the spatial, temporal, and thermal overlap between juvenile salmonids and introduced species to minimize potential for negative interactions (Figure 12).

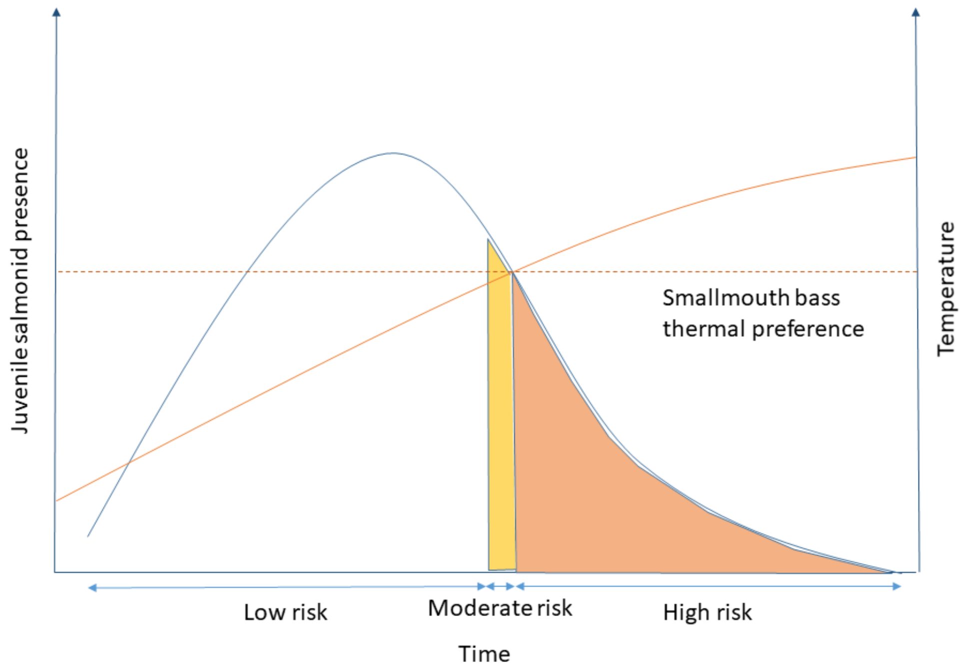

Figure 14. Conceptual model of interaction potential between smallmouth bass and juvenile salmonids.

Conceptual Alternatives

The products from this initial conceptual design should include site assessment, topographic/bathymetric survey, and development of conceptual level designs. The site assessment and topographic/bathymetric survey should inform the development of potential alternatives. The alternatives will be developed based on CTUIR and USFWS goals and objectives for the site. The selected contractor will work closely with CTUIR and USFWS, as well as other stakeholder groups during the alternatives analysis to ensure compliance with project goals.

The design elements considered in the alternatives analysis will be process-based and consider all restoration possibilities within the floodplain and active channel given existing on-site hydrologic, geomorphologic, and land management constraints with respect to watershed influence. Design elements are anticipated to include, but are not limited to, some combination of channel modification, channel relocation, side channel creation, off-channel habitat creation, floodplain topography modification, wetland creation and modification, water control system modification, large wood placement, and low-tech process-based restoration methods.

The contractor will be expected to review, analyze and incorporate existing data and collect other data as necessary for describing and predicting specific hydrologic conditions related to floodplain connectivity, water quality, channel morphology, aquatic habitat, and riparian and upland vegetation. This includes, but is not limited to, specific hydrologic conditions and channel function within the watershed and project area related to floodplain connectivity, water temperature, channel morphology, aquatic habitat, and riparian and upland vegetation. Proper assessment of existing and historical site conditions needs to be adequately described by the contractor to help inform the Partners in their decision making.

The preferred alternative will be developed to a conceptual level design. The conceptual design will be used by the Partners to further engage stakeholders and interest groups and to pursue future funding sources. This conceptual design will be used as the foundation for future project development and should be robust and include representations of physical changes that are expected to occur in the Refuge.

Data Availability

Multiple datasets, both public and proprietary, are available to the selected contractor. These data include, but are not limited to:

- USGS Gage 14018500 (1949-Present period of record)
- 2015 Bathymetric and vessel mounted LiDAR survey data collected for CTUIR GAAP (2014)
- GIS database of known infrastructure and easement locations
- 2002 Washington Department of Ecology FLIR data
- 2020 NAIP Imagery
- 2017 NIR LiDAR
- Fish monitoring data including distribution, smolt trap data, and PIT array detections
- Riparian Condition Analysis completed by CTUIR
- Beaver Restoration Analysis Tool completed by CTUIR
- Bird observation data collected from eBird
- USACE McNary Dam Forebay Elevations and Columbia Flow data
- Historic Aerial Photos
- Historic GLO survey and expedition notes

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