U.S. Fish & Wildlife Service

Mid-Columbia Recovery Unit Implementation Plan for Bull Trout

(Salvelinus confluentus)

Above: Bull trout pair;

Left: Bull trout habitat in Lostine River, Oregon;

Photographs: Mary Edwards

Mid-Columbia Recovery Unit

Implementation Plan

for

Bull Trout (*Salvelinus confluentus*)

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Prepared by

Oregon Fish and Wildlife Office

U.S. Fish and Wildlife Service

Portland, Oregon

with assistance from

Central Washington, Northern Idaho, and Eastern Washington Field Offices

U.S. Fish and Wildlife Service

and

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Conservation and Recovery Program

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Introduction

This recovery unit implementation plan (RUIP) describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the Mid-Columbia Recovery Unit (Mid-C RU), including estimates of time required and cost. This document supports and complements the Recovery Plan for the Coterminous United States Population of Bull Trout (USFWS 2015a), which describes recovery criteria and a general range-wide recovery strategy for the species. Detailed discussion of species status and recovery actions within each of the six recovery units are provided in six RUIPs that have been developed in coordination with State, Federal, Tribal, and other conservation partners. This document incorporates our responses to public comment on the Draft Mid-Columbia RUIP (USFWS 2015b) received during the comment period from June 4 to July 20, 2015 (Appendix I).

The Mid-C RU comprises 24 bull trout core areas, as well as 2 historically occupied core areas and 1 research needs area. The Mid-C RU is recognized as an area where bull trout have co-evolved with salmon, steelhead, lamprey, and other fish populations. Reduced fish numbers due to historic overfishing and land management changes have caused changes in nutrient abundance for resident migratory fish like the bull trout. The recovery unit is located within eastern Washington, eastern Oregon, and portions of central Idaho (Figure C-1). Major drainages include the Methow River, Wenatchee River, Yakima River, John Day River, Umatilla River, Walla Walla River, Grande Ronde River, Imnaha River, Clearwater River, and smaller drainages along the Snake River and Columbia River.

The Mid-C RU can be divided into four geographic regions (Table C-1): 1) the Lower Mid-Columbia, which includes all core areas that flow into the Columbia River below its confluence with the Snake River; 2) the Upper Mid-Columbia, which includes all core areas that flow into the Columbia River above its confluence with the Snake River; 3) the Lower Snake, which includes all core areas that flow into the Snake River between its confluence with the Columbia River and Hells Canyon Dam; and 4) the Mid-Snake, which includes all core areas in the Mid-C RU that flow into the Snake River above Hells Canyon Dam. These geographic regions are composed of neighboring core areas that share similar bull trout genetic, geographic

Table C-1. Geographic Regions and Associated River Basins Occupied by Bull Trout in the Mid-Columbia Recovery Unit.

Lower Mid-Columbia	*Upper Mid-Columbia*	*Lower Snake*	*Middle Snake*
John Day River	Salmo River	Clearwater River	Powder River
Umatilla River	Methow River	Tucannon River	Pine Creek
Walla Walla River	Entiat River	Asotin Creek	Indian Creek
Touchet River	Wenatchee River	Grand Ronde River	Wildhorse Creek
	Yakima River	Imnaha River	

(hydrographic), and/or habitat characteristics. Conserving bull trout in geographic regions allows for the maintenance of broad representation of genetic diversity, provides neighboring core areas with potential source populations in the event of local extirpations, and provides a broad array of options among neighboring core areas to contribute recovery under uncertain environmental change.

The Mid-C RU also includes seven segments of shared foraging, migration and overwintering (FMO) habitat that are outside core area boundaries but may be used by bull trout originating from multiple core areas. These include the Mid-Columbia River, Snake River, John Day River, Clearwater River, Grande Ronde River, Okanagan River, and Lower Chelan River (Figure C-1). FMO habitat is defined as relatively large streams and mainstem rivers, including lakes or reservoirs, estuaries, and nearshore environments, where subadult and adult migratory bull trout forage, migrate, mature, or overwinter. This habitat is typically downstream from spawning and rearing habitat and contains all the physical elements to meet critical overwintering, spawning migration, and subadult and adult rearing needs. While year-round occupancy by bull trout in the seven shared FMO segments in the Mid-C RU is possible, stream temperatures are often prohibitive during the warmest times of the years; thus occupancy is more common from late fall through late spring. More detailed descriptions of these shared FMO segments follow later in this RUIP.

Changes have been made to some core areas since the 2002 Draft Bull Trout Recovery Plan. First, within the Lower Snake geographic region, the Grande Ronde River Core Area has been divided into three separate core areas, along with the Grande Ronde River FMO. These three new core areas include: 1) Lookingglass Creek/Wenaha River Core Area; 2) Upper Grande Ronde Core Area (*i.e.*, Catherine Creek and Indian Creek); and 3) the Wallowa River/Minam River Core Area. The decision to split the former Grande Ronde Core Area into three separate core areas was based on distribution patterns determined from telemetry studies of fish tagged in the Wenaha and Lostine Rivers and Lookingglass Creek, differences in the environmental characteristics among the local populations, and the likelihood for genetic exchange and demographic linkage given the size of the Grande Ronde River basin. The Little Minam River is still its own core area.

Within the Clearwater River basin, the Fish Lake (North Fork Clearwater River) Core Area was absorbed into the North Fork Clearwater River Core Area, and the Fish Lake (Lochsa River) Core Area was absorbed into the Lochsa River Core Area. It was determined that while these two Fish Lake populations are adfluvial[1], they are not isolated from the other two core areas and represent a continuation of the headwater populations in both the Lochsa River and North Fork Clearwater River core areas. Additionally, the Lower-Middle Clearwater River is no longer a core area, but is now considered FMO habitat because it was determined that Lolo Creek is not a local population, which leaves no local populations in the Lower-Middle Clearwater River. However, the mainstem Clearwater still provides access to the other core areas in the Clearwater River basin, providing FMO habitat and connectivity.

In the Middle Snake geographic region, the Eagle Creek basin was removed from the Powder River Core Area and given its own core area status because it is located some distance from the rest of the Powder River bull trout populations and contains somewhat different habitat. However, because there is no information available documenting current bull trout occupancy of Eagle Creek, this watershed is best described as a historic core area. Sheep Creek and Granite Creek have been removed as core areas since it has been determined that these watersheds do not support spawning and rearing and year-round occupancy of bull trout. Burnt River has been removed as a research needs area as there is no information supporting historic occupancy of this watershed by bull trout and uncertainty as to the current suitability of existing habitat.

Within the Upper-Mid Columbia geographic region, the Lake Chelan basin is now considered a core area. However, because it is currently unoccupied it is best described as a historic core area. It retains potential for restoration of native fish assemblages, and because of its cold waters it may provide refuge habitat as climate change progresses. The short segment of the lower Chelan River below Lake Chelan is now considered FMO habitat, as is the Okanogan River. The area east of the Okanogan River (upstream from Chief Joseph Dam) is recognized as a research needs area (formerly Eastern Washington, but retitled Northeastern Washington Research Needs Area). It is also considered a core area in a basic sense, but is unoccupied and more information is required to determine its potential for supporting bull trout in the future.

[1] Adfluvial: Life history pattern of spawning and rearing in tributary streams and migrating to lakes or reservoirs to mature.

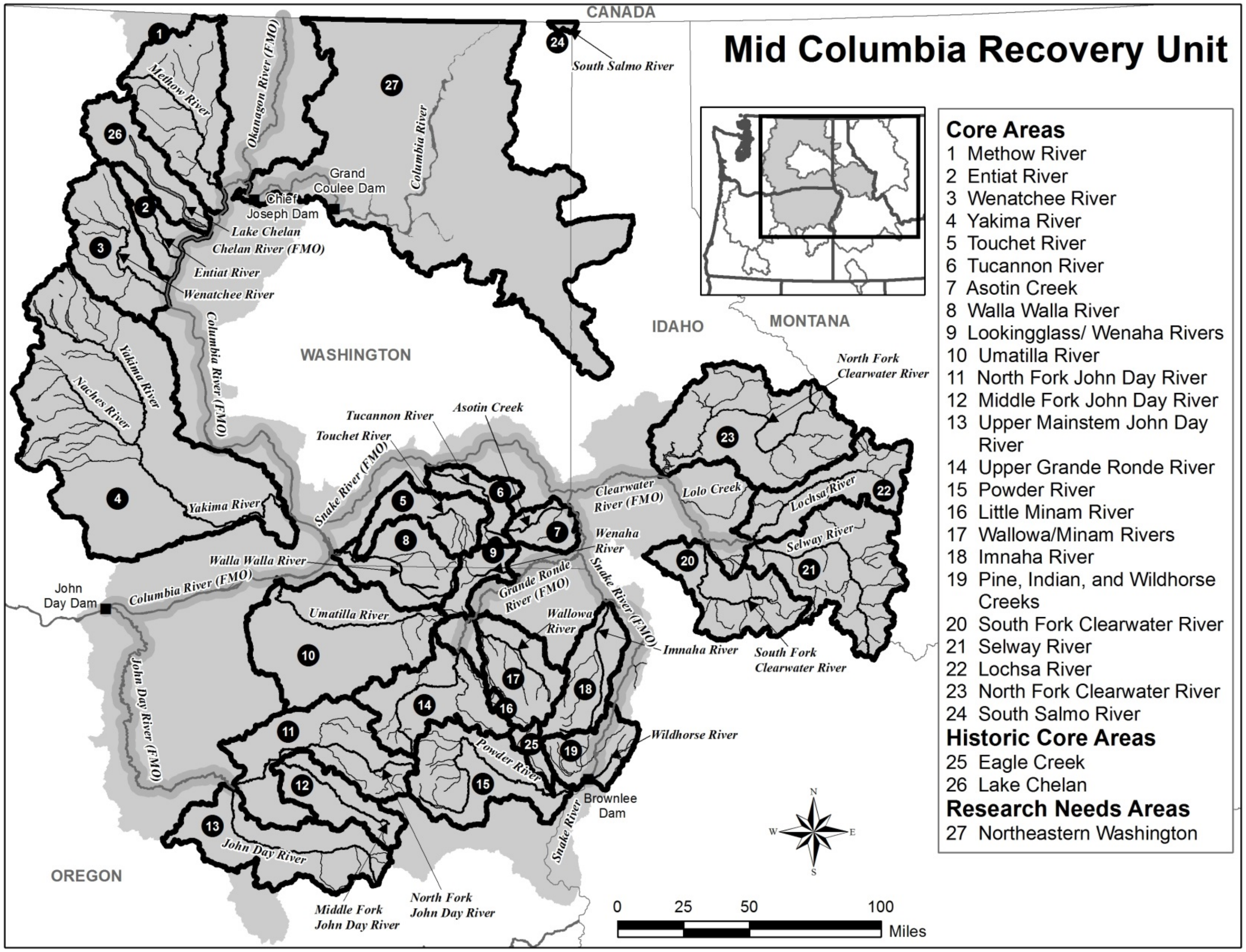

Figure C-1. Map of the Mid-Columbia Recovery Unit for Bull Trout.

The Salmo River, the South Fork of which originates in Northern Idaho and northeast Washington, been added as a core area given recent information documenting spawning and rearing and year-round occupancy in the South Fork local population. The remaining three local populations persist in British Columbia.

Current Status of Bull Trout in the Mid-Columbia Recovery Unit

The current demographic status of bull trout in the Mid-Columbia Recovery Unit is highly variable at both the RU and geographic region scale. Some core areas, such as the Umatilla, Asotin, and Powder Rivers, contain populations so depressed they are likely suffering from the deleterious effects of small population size. Conversely, strongholds do exist within the recovery unit, predominantly in the Lower Snake geographic area. Populations in the Imnaha, Little Minam, Clearwater, and Wenaha Rivers are likely some of the most abundant. These populations are all completely or partially within the bounds of protected wilderness areas and have some of the most intact habitat in the recovery unit. Status in some core areas is relatively unknown, but all indications in these core areas suggest population trends are declining, particularly in the core areas of the John Day Basin. More detailed description of bull trout distribution, trends, and survey data within individual core areas is provided below in Appendix II.

Lower Mid-Columbia Region

In the Lower Mid-Columbia Region, core areas are distributed along the western portion of the Blue Mountains in Oregon and Washington. Only one of the six core areas is located completely in Washington. Demographic status is highly variable throughout the region. Status is the poorest in the Umatilla and Middle Fork John Day Core Areas. However, the Walla Walla River core area contains nearly pristine habitats in the headwater spawning areas and supports the most abundant populations in the region. Most core areas support both a resident[2] and fluvial[3] life history; however, recent evidence suggests a significant decline in the resident and fluvial life history in the Umatilla River and John Day core areas respectively. Connectivity between the core areas of the Lower Mid-Columbia Region is unlikely given conditions in the connecting FMO habitats. Connection between the Umatilla, Walla Walla and Touchet core areas is uncommon but has been documented, and connectivity is possible between core areas in

[2] Resident: Life history pattern of residing in tributary streams for the fish's entire life without migrating.
[3] Fluvial: Life history pattern of spawning and rearing in tributary streams and migrating to larger rivers to mature.

the John Day Basin. Connectivity between the John Day core areas and Umatilla/Walla Walla/Touchet core areas is unlikely.

Upper Mid-Columbia Region

In the Upper Mid-Columbia Region, core areas are distributed along the eastern side of the Cascade Mountains in Central Washington. This area contains four core areas (Yakima, Wenatchee, Entiat, and Methow), the Lake Chelan historic core area, and the Chelan River, Okanogan River, and Columbia River FMO areas. The core area populations are generally considered migratory, though they currently express both migratory (fluvial and adfluvial) and resident forms. Residents are located both above and below natural barriers (*i.e.*, Early Winters Creek above a natural falls; and Ahtanum in the Yakima likely due to long lack of connectivity from irrigation withdrawal). In terms of uniqueness and connectivity, the genetics baseline, radio-telemetry, and PIT tag studies identified unique local populations in all core areas. Movement patterns within the core areas; between the lower river, lakes, and other core areas; and between the Chelan, Okanogan, and Columbia River FMO occurs regularly for some of the Wenatchee, Entiat, and Methow core area populations. This type of connectivity has been displayed by one or more fish, typically in non-spawning movements within FMO. More recently, connectivity has been observed between the Entiat and Yakima core areas by a juvenile bull trout tagged in the Entiat moving in to the Yakima at Prosser Dam and returning at an adult size back to the Entiat. Genetics baselines identify unique populations in all four core areas. Refer to Appendix II for additional information.

The demographic status is variable in the Upper-Mid Columbia region and ranges from good to very poor. The U.S. Fish and Wildlife Service (Service) 2008 5-year Review and Conservation Status Assessment described the Methow and Yakima at risk, with a rapidly declining trend. The Entiat was listed at risk with a stable trend, and the Wenatchee as having a potential risk, and with a stable trend. Currently, the Entiat is considered to be declining rapidly due to much reduced redd counts. The Wenatchee is able to exhibit all freshwater life histories with connectivity to Lake Wenatchee, the Wenatchee River and all its local populations, and to the Columbia River and/or other core areas in the region. In the Yakima core area some populations exhibit life history forms different from what they were historically. Migration between local populations and to and from spawning habitat is generally prevented or impeded by headwater storage dams on irrigation reservoirs, connectivity between tributaries and reservoirs, and within lower portions of spawning and rearing habitat and the mainstem Yakima River due to changed flow patterns, low instream flows, high water temperatures, and other habitat impediments. Currently, the connectivity in the Yakima Core area is truncated to the degree that not all populations are able to contribute gene flow to a functional metapopulation.

Lower Snake Region

Demographic status is variable within the Lower Snake Region. Although trend data are lacking, several core areas in the Grande Ronde Basin and the Imnaha core area are thought to be stable. The upper Grande Ronde Core Area is the exception where population abundance is considered depressed. Wenaha, Little Minam, and Imnaha are strongholds (as mentioned above), as are most core areas in the Clearwater River basin. Most core areas contain populations that express both a resident and fluvial life history strategy. There is potential that some bull trout in the upper Wallowa River are adfluvial. There is potential for connectivity between core areas in the Grande Ronde basin, however conditions in FMO are limiting.

Middle Snake Region

In the Middle Snake Region, core areas are distributed along both sides of the Snake River above Hells Canyon Dam. The Powder River and Pine Creek basins are in Oregon and Indian Creek and Wildhorse Creek are on the Idaho side of the Snake River. Demographic status of the core areas is poorest in the Powder River Core Area where populations are highly fragmented and severely depressed. The East Pine Creek population in the Pine-Indian-Wildhorse core area is likely the most abundant within the region. Populations in both core areas primarily express a resident life history strategy; however, some evidence suggests a migratory life history still exists in the Pine Creek-Indian-Wildhorse core area. Connectivity is severely impaired in the Middle Snake Region. Dams, diversions and temperature barriers prevent movement among populations and between core areas. Brownlee Dam isolates bull trout in Wildhorse Creek from other populations.

Factors Affecting Bull Trout in the Mid-Columbia Recovery Unit

Table C-2 summarizes the primary threats affecting bull trout for each core area in the Mid-Columbia Recovery Unit.

Upland management and riparian restoration actions should be implemented by land management agencies throughout the region, in coordination with private landowners. In general, the major actions needed in eastern Washington and northeastern Oregon watersheds are screening of irrigation diversions, removing culverts or other fish passage barriers, and improving instream flow to allow connectivity between FMO and spawning/rearing habitat.

Fish passage needs to be established at several Bureau of Reclamation dams in the Yakima core area. In core areas adjoining the Snake River (*e.g.*, Grande Ronde, Imnaha, Powder, Pine, Indian, and Wildhorse), effects of the Snake River dams and various tributary reservoirs on bull trout movement should be assessed; two-way fish passage should be established if feasible to restore population connectivity within or between core areas. Brook trout are identified as a factor impacting bull trout within multiple core areas in the Mid-Columbia Recovery Unit. In this recovery unit the level of effect from brook trout on bull trout is site-specific and variable depending on a number of factors (*e.g.*, baseline habitat condition, amount of available habitat, bull trout access to refugia, brook trout densities, and water temperature). At sites where effects of brook trout are significant and control actions are feasible, brook trout populations should be reduced to minimize these effects. High priority areas include the John Day, Powder and Umatilla basins. Measures to prevent spread of brook trout to new streams should be considered and implemented where appropriate.

Effective monitoring programs are needed to determine whether recovery actions for bull trout are successful and to help determine where and when recovery criteria have been achieved. Monitoring may include assessing distribution, population status, life history, migratory movements, and genetic characteristics of bull trout in each recovery unit. In addition, evaluating monitoring efforts, management practices such as those for water diversion screening, grazing, timber harvest, and riparian management should be evaluated for their effectiveness in reducing impacts on bull trout. For example, the identification of core areas and watersheds within the Mid-Columbia Recovery Unit that are most likely to maintain habitats suitable for bull trout over the foreseeable future under probable climate change scenarios will also help guide the allocation of bull trout conservation resources to improve the likelihood of success.

The Imnaha, Wenaha, Wenatchee, and Clearwater River basins currently contain the healthiest and most stable bull trout populations in the recovery unit and should be particularly managed to maintain these populations and prevent introduction of new threats.

Table C-2. Primary Threats to Bull Trout in the Mid-Columbia Recovery Unit.

Geographic Region Core Area (Complex) *Core Area (Simple)*	Number of Local Populations	PRIMARY THREATS[1]		
		Habitat	***Demographic***	***Nonnative***
Lower Mid-Columbia Geographic Region				
Upper Mainstem John Day River	**2**	**Upland/ Riparian Land Management** (1.1) Legacy and current livestock grazing and agricultural practices have degraded riparian and instream habitat quality. **Water Quality** (1.3) Agricultural practices and livestock grazing (current and legacy) have resulted in increases in instream water temperatures and low flows due to irrigation activities, altered channel conditions, and lack of shade.	**Connectivity Impairment** (2.1) Fish passage issues and entrainment at diversions and push up dams, as well as low flow conditions and temperature barriers created by irrigation activities, reduce connectivity within and among populations. **Small Population Size** (2.3) Critically low abundance and decline in fluvial life history component limits recovery potential and may have deleterious genetic effects.	**None**

Geographic Region **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS[1]**		
		Habitat	***Demographic***	***Nonnative***
Middle Fork John Day River	**3**	**Upland/ Riparian Land Management** (1.1) Legacy timber harvest, mining, and livestock grazing have resulted in warm water temperatures, loss of cold water storage, degraded channel networks and a lack of structural integrity. **Water Quality** (1.3) Forest management practices, livestock grazing, and mining have resulted in warm water temperatures and low flows in rearing areas and FMO habitat limiting movement and distribution.	**Connectivity Impairment** (2.1) Temperature barriers in the Middle Fork John Day River, as well as passage issues at diversions, old log weirs and road culverts in the tributaries impair connectivity between populations. **Small Population Size** (2.3) Putative declines in recent years have put populations in the core area at higher risk of genetic and demographic stochasticity.	**None**
North Fork John Day River	**7**	**Upland/ Riparian Land Management** (1.1) Legacy and current mining wctivities, livestock grazing, forest management, and agricultural impacts have resulted in high water temperatures, sedimentation, degraded channel networks and loss of instream complexity. **Instream Impacts** (1.2) Current and legacy mining wctivity has disconnected streams from floodplain and interrupted natural hydrology, impacting water quality and stream temperature in FMO habitats.	**Connectivity Impairment** (2.1) Fish passage issues at culverts, temperature barriers, and entrainment impact bull trout migratory behavior.	**Nonnative Fishes** (3.1) Hybridization and competition with brook trout pose a serious risk to bull trout. Brook trout are present in all populations except Trail Creek.

<u>**Geographic Region**</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS**[1]		
		Habitat	***Demographic***	***Nonnative***
Umatilla River	**1**	**Upland/Riparian Land Management** (1.1) <u>Livestock grazing and agricultural practices</u>, and <u>transportation networks</u> have eliminated or reduced riparian cover, resulting in a loss of habitat complexity and warm water temperatures. **Instream Impacts** (1.2) <u>Transportation networks</u> and <u>agricultural practices</u> have channelized and oversimplified the river channel, eliminating important wetlands and floodplain interaction, decreasing instream flows and increasing water temperatures. **Water Quality** (1.3) High instream water temperatures as a result of intense land use activities mentioned above significantly limit summer rearing habitat for migratory fish, the predominant life history type. Increased water temperatures and loss of available habitat due to climate change are predicted as a high risk to this core area.	**Connectivity Impairment** (2.1) <u>Passage barriers</u> in the lower Umatilla River and warm water <u>temperature barriers</u> impede free movement of bull trout between spawning and rearing areas and FMO habitat. **Small Population Size** (2.3) Critically low abundance and an apparent reduction in the resident life history type put the core area at high risk of <u>genetic and demographic stochasticity</u>.	**None**

Geographic Region Core Area (Complex) *Core Area (Simple)*	Number of Local Populations	PRIMARY THREATS[1]		
		Habitat	***Demographic***	***Nonnative***
Walla Walla River	**3**	**Upland/Riparian Land Management** (1.1) Agricultural practices, transportation networks, rural and urban developments and other land management actions have eliminated or reduced riparian cover and protective buffers, resulting in the loss of habitat complexity, increased input of pollutants and storm-water runoff, and increased water temperatures. **Instream Impacts** (1.2) Flood control and water Management activities have eliminated complex channels and floodplain interaction, altered and reduced flows, and increased water temperatures particularly in FMO habitats. **Water Quality** (1.3) High instream water temperatures as a result of intense land use activities mentioned above significantly limit FMO for migratory fish. Increased water temperatures and loss of available habitat due to climate change are predicted as a high risk to this core area.	**Connectivity Impairment** (2.1) Entrainment at diversions and passage barriers, as well as temperature barriers and low flows, prevent bull trout from moving freely and easily between FMO and spawning habitats.	**Nonnative Fishes** (3.1) Predatory species, such as small mouth bass and walleye, in FMO areas of the mainstem Walla Walla and Columbia Rivers. Competing species, including hatchery origin rainbow and brown trout, in FMO.
Touchet River	**3**	**Upland/Riparian land Management (1.1).** Transportation network, rural and urban development, agriculture, logging and recreational (*e.g.*, campground, ski resort, etc.)	**Connectivity Impairment** (2.1) Barriers at the Dayton Steelhead Acclimation Pond Dam and on private property prevent or limit free movement and connectivity between FMO and spawning/rearing areas, as well as	**Nonnative Fishes** (3.1) Predatory species, such as small mouth bass and walleye, in FMO areas of the lower Touchet River and mainstem Walla Walla River.

Geographic Region **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS**[1]		
		Habitat	***Demographic***	***Nonnative***
		impacts on the riparian buffers, reduced shade, increased runoff, sedimentation, and water temperatures, plus changes to water discharge levels. Legacy and new recreational development impacted spawning and rearing habitat with recreational rock dam building, reduced riparian areas, and compacted stream banks, and reduced habitat complexity. **Instream Impacts** (1.2) Flood control and transportation networks that have led to channelization, loss of floodplain connectivity, levee installation and loss of habitat complexity and diversity throughout entire core area, especially in lower Touchet River. **Water Quality** (1.3) Contaminants, sedimentation, and temperature impairments both from current and legacy practices throughout the watershed have reduced habitat availability and suitability. Existing and predicted future elevated temperatures in the river create thermal barriers to migration and are anticipate to worsen based on forecasted climate modeling.	movement between Walla Walla and Touchet Core Areas.	Competing species, including hatchery origin rainbow and brown trout, in FMO and spawning/rearing areas. As waters warm in climate change scenarios, conditions supporting non-natives are likely to spread.

<u>Geographic Region</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS[1]**		
		Habitat	***Demographic***	***Nonnative***
<u>Upper Mid-Columbia Geographic Region</u>				
Salmo River (South Fork of Salmo River in U.S.)	**4 (1 in U.S.)**	**Upland/Riparian Land Management** (1.1) Legacy and ongoing forestry and mining practices (roads, sediment) and development causing loss of wood, pool reduction, potential contaminants, and instream degradation within the Canadian portions; coordinate with British Columbia.	**Connectivity Impairment** (2.1) Impacts to connectivity from artificial and natural barriers to historically connected wetlands and tributaries as a result of development, road systems, beaver activity, and subsurface flows; coordinate with Canada. **Fisheries Management** (2.2) Legacy impacts of overharvest and current illegal harvest in Canada that may also occur at international border; coordinate with British Columbia. **Forage Fish Availability (2.4)** Loss of and limited availability of prey base, nutrients, and native salmon due to downstream barriers on mainstem Pend Oreille and Columbia Rivers; coordinate with British Columbia.	**None**

<u>Geographic Region</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS**[1]		
		Habitat	***Demographic***	***Nonnative***
Yakima River	**15**	**Upland/Riparian Land Management** (1.1) <u>Agriculture/Livestock Grazing/Forest Management Practices</u>. Legacy and current practices, including forest roads, have resulted in a lack of habitat complexity (*i.e.*, wood, primary pools, functioning floodplains). Agriculture practices have channelized streams, altered floodplains, and reduced riparian vegetation. <u>Development/Transportation Networks</u>. Legacy and current structures and features impact both spawning and rearing and FMO habitat. <u>Recreation</u>. Legacy and new recreational developments impact spawning and rearing habitat with rock dam building, reduced riparian areas, and compacted stream banks, and reduced habitat complexity. **Instream Impacts** (1.2) <u>Agriculture/Forest Management Practices/Grazing/Development/Transportation Networks/ Recreation</u>. Legacy and current management actions have degraded habitat, impacted stream channels, altered fish passage, reduced water flows, and constricted floodplains. Legacy	**Connectivity Impairment** (2.1) <u>Agriculture</u>. The Yakima basin has impassable dams built as part of irrigation. Many 303d listed reaches occur across the basin. Stream temperature and agriculture chemicals have legacy and current impacts that reduce quality of FMO and degrade connectivity for bull trout populations. <u>Forest Management/ Grazing/Recreation/ Transportation Networks</u>. Legacy and current forest roads/highways/county roads continue to impair connectivity for migration. Grazing in spawning areas disrupts and causes trampling of redds. Recreation areas have user built rock dams blocking passage. Forest Management and Transportation Networks have blocked and impeded passage. <u>Dewatering</u>. Stream reaches naturally dewater in several spawning and rearing and FMO areas during times of low snowpack/rain and maybe further impacted with climate change or additional management impacts. <u>Entrainment (hydropower and diversions)/Fish Passage/Altered Flows</u>. Entrainment and altered flows from federal and private diversion/dams affect connectivity within FMO and spawning and rearing areas. Within tributaries, water withdrawals can also affect connectivity. Altered flows and Climate change have/will have caused reduced or	**Nonnative Fishes** (3.1) <u>Introduced Species/Fish management.</u> Brook, lake, and brown trout are non-native predators in the basin and impact recovery. Salmon recovery involves output of high numbers of smolts, with some residualization and species competition which may have impacts to preybase or small populations of bull trout. Genetic analysis has identified F2 (brook x bull trout) hybrids within the basin. <u>Climate Change</u>. Predatory non-native species (lake and brown trout, spiny-ray fishes) occur within FMO habitats and risk potential spread esp. as waters warm with climate change.

Geographic Region Core Area (Complex) Core Area (Simple)	Number of Local Populations	PRIMARY THREATS[1]		
		Habitat	*Demographic*	*Nonnative*
		timber, fire, recreation, and grazing management has degraded stream reaches, contributed to sedimentation, reduced riparian areas, and contributed to high stream temperatures. Current grazing management plans need to be maintained and improved in spawning areas. Highways, county roads along FMO and development reduce habitat complexity and degrade water quality. Dewatering and Altered Flows. Some streams naturally dewater and are impacted during low flow years. Current operation of large BOR reservoirs mainstem diversion dams, and private irrigators have altered instream flows and contributes poor water quality. Water management and flood control have simplified river channels, eliminating important wetlands and floodplain connectivity in FMO habitat. Also see above threats. Entrainment and Connectivity/Fish Passage. Irrigation dams and diversions have altered channel structure and complexity. Mining Impacts. Legacy and current suction dredging practices	limited use of migratory corridors in FMO habitats. Limited Extent of Habitat. Passage is impacted on streams that already have natural limitation on amounts of habitat available. Climate Change. Climate change is predicted to impact stream flows and temperatures that will cause barriers for passage and reduced refuge. **Fisheries Management** (2.2) Angling/Harvest/Poaching. Fishing regulations and harvest rules need to continue protect bull trout. Illegal poaching occurring in several basins. Fisheries Management. Increased fish management and need for monitoring causes increased handling impacts. **Small Population Size** (2.3). Genetic/Demographic Stochasticity. Most populations in the basin are small and unstable or stable at very low numbers. Some are disconnected due to fish passage barriers at BOR's Yakima Irrigation Project dams and diversions, and road culverts that impede passage. Recent downward trends in several populations are a concern. Loss/Altered Migratory Life History. Life histories have been altered due to long term passage impediment and/or total obstruction of fish passage from	

Geographic Region Core Area (Complex) *Core Area (Simple)*	Number of Local Populations	PRIMARY THREATS[1]		
		Habitat	***Demographic***	***Nonnative***
		lead to increased sediments and reduced complexity. Water Quality Impairment. Both legacy and current management has led to 303d listed reaches with water quality degradation. Standards are frequently not met in FMO areas. Irrigation returns, runoff, application of pesticides/herbicides/ deicer impacts occur adjacent to FMO and several rearing areas. Climate Change. Current science predicts temperature changes will greatly impact stream flow/temperature patterns in the Yakima basin. Quality of the lower elevation spawning and rearing habitat and FMO are at risk and are predicted to be further degraded.	large mainstem dams operated by BOR, forest practices, and other past actions. **Forage Fish Availability** (2.4) Fish Passage/ Introduced Species/Fish management. BOR large dams, diversions, and forest/county/State highway road culverts block passage for potential native prey species. Salmon and Steelhead hatchery releases may both impact and benefit bull trout (esp. where low numbers of bull trout exist). Lake, brown, and brook trout outcompete bull trout for habitat and food.	
Wenatchee River	**7**	**Upland/Riparian Land Management** (1.1) Agriculture/Livestock Grazing/ Forest Management Practices. Legacy and current practices including forest roads have resulted in a lack of habitat complexity (*i.e.*, wood, primary pools, functioning floodplains). Agriculture practices have channelized and reduced riparian vegetation. Development/Transportation Networks. Legacy and current	**Connectivity Impairment** (2.1) Agriculture. Irrigation diversions cause fish passage barriers and entrainment. Some reaches within spawning and rearing and FMO have listed 303d listed reaches. Stream temperature and agriculture chemicals have legacy and current impacts to FMO habitat and reduce complex habitat and impact connectivity of bull trout habitat. Forest Management/Transportation Networks. Legacy and current forest roads/highways/county roads continue to impair connectivity for migration. Forest	**Nonnative Fishes** (3.1) Introduced Species/Fish management. Brook, lake, and brown trout are non-native predators in the basin and can impact recovery. Brook trout overlap with bull trout in both spawning and rearing and FMO habitat. The distribution of lake and brown trout are unknown, and may alter with climate change. Fisheries still occur on brook, brown, and lake trout. Genetic analysis has

Geographic Region Core Area (Complex) *Core Area (Simple)*	Number of Local Populations	PRIMARY THREATS[1]		
		Habitat	***Demographic***	***Nonnative***
		roads and railroads impact both spawning and rearing and FMO habitats. Recreation. Legacy and new recreational developments impact spawning and rearing habitat (*i.e.*, rock dam building, reduced riparian areas, and compacted stream banks) and reduce habitat complexity. **Instream Impacts** (1.2) Agriculture/Forest Management Practices/Grazing/Development/ Transportation Networks. Legacy and current management actions have degraded habitat and impacted stream channels, altered fish passage, reduced water flows, and constricted floodplains. Legacy timber, fire, recreation, and grazing management have added impacts to sediments, reduced riparian areas, stream temperatures. Current grazing management plans need to be maintained and improved in spawning areas and FMO areas. Highways, railroads, county roads along FMO development reduce complexity, create passage issues, and degrade water quality. Dewatering and Altered Flows. There are reaches of stream in FMO and spawning and rearing areas that naturally dewater and	Management and Transportation systems have impeded passage and have reduced habitat complexity. Dewatering. Stream reaches naturally dewater during times of low snowpack/rain and maybe further impacted with climate change. Entrainment (hydropower and diversions)/Fish Passage/Altered Flows. Entrainment and altered flows occur at all hydropower dams on the Columbia River and at other diversions/dams in the Wenatchee core area where fish passage is impeded. Some passage barriers alter timing and migration from spawning/rearing to migration areas. Altered flows and climate change have or will have caused reduced or limited use of some migratory corridors. Climate Change. Climate change is predicted to impact stream flows and temperatures that will cause barriers for passage and reduced refuge. **Fisheries Management** (2.2) Angling/Harvest/Poaching. Fishing regulations and harvest rules have improved but need to continue protect bull trout. Illegal poaching occurring in several basins. Introduced Species. Brook trout overlap with bull trout in both spawning and rearing and FMO habitat.	identified brook x bull trout hybrids within the basin. Salmon recovery involves output of high numbers of smolts, with some residualization and species competition which may have impacts to preybase and small populations of bull trout. Climate Change. Predatory non-native species occur within FMO habitats and risk potential spread esp. as waters warm with climate change.

<u>Geographic Region</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS[1]**		
		Habitat	***Demographic***	***Nonnative***
		are further impacted during low flow years. Mainstem diversion dams have also altered instream flows and water quality. <u>Entrainment and Connectivity/Fish Passage</u>. Hydropower dams on the mainstem Columbia R., irrigation dams, historic dams (*i.e.*, Tumwater Dam), and splash dams altered channel structure, cause harm, and impede fish passage. <u>Mining Impacts</u>. Legacy and current suction dredging practices lead to increased sediments and altered spawning and rearing habitat. <u>Water Quality Impairment</u>. Both legacy and current management has led to 303d listed reaches with water quality degradation. Standards are frequently not met in FMO areas. Irrigation returns, runoff, application of pesticides/herbicides/ deicer impacts occur in adjacent FMO and several spawning and rearing areas. <u>Climate Change</u>. Current science predicts temperature changes will impact stream flow and stream temperature. Quality of the lower elevation spawning and rearing habitat and FMO will be further	<u>Fisheries Management.</u> Increased fish management and need for fish monitoring causes increased handling impacts. Species interactions from hatchery fish are likely, esp. in areas of overlap with bull trout populations; the degree of impacts is unknown. **<u>Small Population Size</u>** (2.3) <u>Genetic/ Demographic Stochasticity</u>. Half of the local populations in the basin are small and unstable or stable at very low numbers. <u>Loss/Altered Migratory Life History</u>. Life histories have been altered due to long term impediment of fish passage at long time diversion dams . <u>Fisheries Management</u>. Species interactions from hatchery released smolts/fish and may be greatest where they overlap with low abundance bull trout populations. **Forage Fish Availability** (2.4) <u>Fish Passage/Introduced Species/Fish management</u>. Columbia River dams, irrigation diversions, and legacy splash dams or road culverts currently or historically impede passage for potential prey species. Hatchery releases may both impact and benefit bull trout (esp. where low numbers of bull trout exist. Lake, brown, and brook trout outcompete bull trout for habitat and food.	

Geographic Region Core Area (Complex) *Core Area (Simple)*	Number of Local Populations	PRIMARY THREATS[1]		
		Habitat	***Demographic***	***Nonnative***
		degraded (stream temps, turbidity, sediments, dissolved oxygen levels).		
Entiat River	**2**	**Upland/Riparian Land Management** (1.1) Agriculture/Livestock Grazing/ Forest Management Practices. Legacy and current practices including forest roads have resulted in a lack of complex habitat (*i.e.*, wood, primary pools, functioning floodplains). Agriculture practices have channelized and reduced riparian vegetation and floodplain functions. Development/Transportation Networks. Legacy and current facilities impact both spawning and rearing and FMO habitat. Recreation. Legacy and new recreational developments impact spawning and rearing habitat (*i.e.*, rock dam building, reduced riparian areas, and compacted stream banks) and reduce habitat complexity. **Instream Impacts** (1.2) Agriculture/Forest Management Practices/Development/ Transportation Networks. Legacy and current management actions have degraded habitat. Past timber, fire, recreation, and	**Connectivity Impairment** (2.1) Agriculture. Irrigation diversions block fish passage and cause entrainment. Some reaches within spawning and rearing and FMO have 303d listed reaches. Stream temperature and agricultural chemicals have legacy and current impacts and reduce habitat complexity and connectivity of bull trout habitat. Forest Management/ Transportation Networks. Legacy and current forest roads/highways/county roads continue to impair connectivity for migration. Forest Management and Transportation systems have impeded passage and contributed to a lack of complex habitat. Entrainment (hydropower and diversions)/Fish Passage. Entrainment occurs at all hydropower dams on the Columbia River and at other diversions/dams in the Entiat core area where fish passage is impeded, causing altered movement from spawning/rearing to migration areas. Climate change has or will have caused reduced or limited use of migratory corridors. Climate Change. Climate change is predicted to impact stream flows and temperatures that will cause barriers for passage and reduced refuge.	**Nonnative Fishes** (3.1) Introduced Species/Fish management. Brook trout are non-native predators in the basin and will impact recovery. Brook trout overlap with bull trout in both spawning and rearing and FMO habitat. Fisheries still occur on brook trout. Genetic analysis has identified brook x bull trout hybrids within the basin. Salmon recovery involves output of high numbers of smolts, with some residualization and species competition which may have impacts to preybase on small populations of bull trout. Climate Change. Predatory non-native species occur within FMO habitats and risk potential spread esp. as waters warm with climate change.

Geographic Region **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS[1]**		
		Habitat	***Demographic***	***Nonnative***
		grazing management is compounded and impacted stream reaches, increases sediments, reduced riparian areas, stream temperatures. Current grazing management plans need to be maintained and improved in spawning areas. Highways and county roads along FMO and developments in floodplains, reduce complexity, create passage issues, and degrade water quality. Altered Flows. There are streams with naturally dewatering reaches impacted during low flow years. Mainstem diversion dams have altered instream flows and water quality. Entrainment and Connectivity/ Fish Passage. Hydropower dams on the mainstem Columbia R. irrigation dams, and historic splash dams altered channel structure. Water Quality Impairment. Legacy and current management has led to 303d listed reaches with water quality degradation. Standards are frequently not met in FMO areas. Irrigation returns, runoff, application of pesticides/herbicides/deicer impacts FMO and spawning and rearing areas.	**Fisheries Management** (2.2) Angling/Harvest/Poaching. Fishing regulations and harvest rules need to continue to be improved to reduce incidental catch of bull trout. Illegal poaching occurring in several basins. Fisheries Management. Increased fish management and the need for monitoring causes increased handling impacts. Species interactions from hatchery fish are likely, degree of impact are unknown. **Small Population Size** (2.3). Genetic/Demographic Stochasticity. Both populations in the basin are very small and unstable or stable at very low numbers. Recent downward trends are a concern. Loss/Altered Migratory Life History. Life histories have been altered due to long term impediment of fish passage at long time diversions, large hydropower Columbia River dams, and splash dams. Almost all migratory fish use the Columbia River for FMO habitat. Fisheries Management. Species interactions from hatchery released smolts may be greatest on low abundance populations. **Forage Fish Availability** (2.4) Fish Passage/Introduced Species/Fish management. Columbia River dams, irrigation diversions, and legacy splash	

<u>Geographic Region</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS[1]**		
		Habitat	***Demographic***	***Nonnative***
		<u>Climate Change</u>. Current science predicts temperature changes will impact stream flow/ temperature patterns in. Quality of the lower elevation spawning and rearing habitat and FMO will be further degraded (stream temps, turbidity, sediments, dissolved oxygen levels).	dams or other culverts currently or historically impede passage for potential native prey species. Hatchery releases may both impact and benefit bull trout. Brook trout outcompete bull trout for habitat and food.	

Geographic Region **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS[1]**		
		Habitat	***Demographic***	***Nonnative***
Methow River	**10**	**Upland/Riparian Land Management** (1.1) Agriculture/Livestock Grazing/ Forest Management Practices. Legacy and current practices including management of forest roads have resulted in reduced habitat complexity (*i.e.*, wood, primary pools, functioning floodplains). Agriculture practices have channelized streams, impacted floodplain functions, and reduced riparian vegetation. Development/Transportation Networks. Legacy and current facilities and roads impact both spawning and rearing and FMO habitat. Recreation. Legacy and new recreational developments impact spawning and rearing habitat (*i.e.*, rock dam building, reduced riparian areas, and compacted stream banks) and reduce habitat complexity. **Instream Impacts** (1.2) Agriculture/Forest Management Practices/Development/ Transportation Networks. Legacy and current management actions have degraded habitat. Past timber, fire, recreation, and grazing management have compounded impacts in stream	**Connectivity Impairment** (2.1) Agriculture. Irrigation Diversions cause impacts to fish passage and entrainment. Some reaches within spawning and rearing and FMO have listed 303d listed reaches. Stream temperature and Agriculture chemicals have legacy and current impacts that reduce habitat complexity and degrade connectivity of bull trout habitat. Forest Management/Transportation Networks. Legacy and current forest roads/highways/county roads continue to impair connectivity for migration. Forest management and transportation systems have impeded passage and contributed to a lack of complex habitat. Dewatering. Several streams naturally dewater during times of low snowpack/rain and may be further impacted with climate change and management impacting these populations. Entrainment (hydropower and diversions)/Fish Passage/Altered Flows. Entrainment and altered flows occur at all PUD and Federal hydropower dams on the Columbia River and at other diversions/dams in the Methow core area where, fish passage is impeded, causing altered movement from spawning/rearing and migration areas. Altered flows and climate change have caused reduced or limited use of migratory corridors. Climate Change. Climate change is	**Nonnative Fishes** (3.1) Introduced Species/Fish management. Brook trout are non-native predators in the basin and will impact recovery. Brook trout overlap with bull trout in both spawning and rearing and FMO habitat. Distribution is unknown. Fisheries for brook trout continue to occur. Salmon recovery involves output of high numbers of smolts, with some residualization and species competition which may have impacts to preybase on small populations of bull trout. Genetic analysis has identified brook x bull trout hybrids within the basin. Climate Change. Predatory non-native species occur within FMO habitats and risk potential spread esp. as waters warm with climate change.

<u>Geographic Region</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS[1]**		
		Habitat	***Demographic***	***Nonnative***
		reaches (*i.e.*, sediments, reduced riparian areas, and high stream temperatures). Current grazing management plans need to be maintained and improved in spawning areas and FMO areas. Highways and county roads along FMO and development in floodplains reduce complexity, create passage issues, and degrade water quality. <u>Dewatering and Altered Flows.</u> Streams with natural dewatering are further impacted during low flow years. Mainstem diversion dams have altered instream flows and water quality. <u>Entrainment and Connectivity/Fish Passage</u>. Hydropower dams on the mainstem Columbia River, Methow mainstem and tributary irrigation dams, and historic splash dams altered channel structure, floodplains, and impede fish passage. <u>Water Quality Impairment</u>. Both legacy and current management has led to 303d listed reaches with water quality degradation. Standards are frequently not met in FMO areas. Irrigation returns, runoff, application of pesticides/herbicides/deicer impacts occur in adjacent FMO	predicted to impact stream flows and temperatures that will cause barriers for passage and reduced refuge. **Fisheries Management** (2.2) <u>Angling/Harvest/Poaching</u>. Fishing regulations and harvest rules need to continue to protect bull trout. Illegal poaching occurs in several areas. <u>Fisheries Management</u>. Increased fish management and need for monitoring causes increased handling impacts. Species interactions from hatchery fish are likely; degree of impact is unknown. **<u>Small Population Size</u>** (2.3). <u>Genetic/ Demographic Stochasticity</u>. Half of the local populations in the basin are small and unstable or stable at very low numbers. Several populations are at the lowest they have been in years. <u>Loss/Altered Migratory Life History</u>. Life histories have been altered due to long term impediment of fish passage at long time PUD dams and irrigation diversions. <u>Fisheries Management</u>. Species interactions from hatchery released smolts and overlapping adult spawners may be greatest on low abundance populations. **Forage Fish Availability** (2.4) <u>Fish Passage/Introduced Species/Fish management</u>. Columbia River dams,	

Geographic Region Core Area (Complex) *Core Area (Simple)*	Number of Local Populations	PRIMARY THREATS[1]		
		Habitat	***Demographic***	***Nonnative***
		and several spawning and rearing areas. Climate Change. Current science predicts temperature changes will impact stream flow and temperature patterns. Quality of the lower elevation spawning and rearing habitat and FMO will be further degraded (stream temps, turbidity, sediments, dissolved oxygen levels).	irrigation diversions, and legacy splash dams or other culverts currently or historically impeded passage for potential native prey species (*i.e.*, other salmonids). Hatchery releases may both impact and benefit bull trout esp. where low numbers of bull trout exist. Brook trout outcompete bull trout for habitat and food.	
Chelan Historic Core Area and Chelan River FMO	**n/a**	**Upland/Riparian Land Management** (1.1) Agriculture/Livestock Grazing/ Forest Management Practices. Legacy and current practices including forest roads have resulted in a lack of habitat complexity in larger tributaries in lower end of Lake Chelan (*i.e.*, wood, primary pools, functioning floodplains). Agriculture practices have reduced riparian vegetation in lower reach of lake. Development/Transportation Networks. Legacy and current facilities and roads impact FMO and tributaries in lower end of Lake basin, Railroad Creek, and Twenty-five mile, and Stehekin. Recreation. Legacy and new recreational developments impact	**Connectivity Impairment** (2.1) Agriculture/Forest Management. Irrigation Diversions and dams cause impacts to fish passage and entrainment. Some areas have listed 303d listed reaches. Stream temperature and agriculture chemicals have legacy impacts. Legacy and current forest roads/highways/ county roads continue to impair connectivity for migration. Forest Management and Transportation Networks have impeded passage and contributed to a lack of complex habitat. Entrainment (hydropower and diversions)/Fish Passage/Altered Flows. Entrainment and altered flows occurs at all hydropower dams on the Columbia River, Chelan dam, at the Chelan power-house, and at other diversions/dams where, fish passage is fully or partially blocked, causing altered movement patterns. Altered flows/Climate change	**Nonnative Fishes** (3.1) Introduced Species/Fish management. Lake and brook trout are non-native predators in the basin and will impact native fish recovery. Brook trout and lake trout overlap native/bull trout habitat. The distribution is unknown. Fisheries occur on both lake and brook trout. Salmon recovery involves output of high numbers of smolts in the Columbia R near the mouth of the Chelan R, with some residualization and species competition which may have impacts to preybase for bull trout. Climate Change. Predatory

<u>Geographic Region</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS[1]**		
		Habitat	***Demographic***	***Nonnative***
		habitat (*i.e.*, riparian areas, compacted stream banks) reduce habitat complexity. **Instream Impacts** (1.2) <u>Agriculture/Forest Management Practices /Transportation Networks</u>. Legacy and current management actions have degraded habitat. Current grazing management plans need to be maintained. Highways, railroads, county roads along FMO reduce complexity, create passage issues, and degrade water quality. <u>Altered Flows</u>. Mainstem Columbia River dams, the Chelan Dam, and powerhouse, and diversion dams, have altered Lake levels, instream flows, and water quality. <u>Entrainment and Connectivity/Fish Passage</u>. Hydropower dams on the mainstem Columbia R, Lake Chelan, and irrigation dams entrained fish, altered habitat, and impacted passage. <u>Water Quality Impairment</u>. Both legacy and current management has led to 303d listed reaches with water quality degradation in Lake Chelan and fish consumption hazards issued. Irrigation returns, runoff,	has/will have caused reduced or limited use of migratory corridors. <u>Climate Change</u>. Climate change is predicted to impact stream flows and temperatures that will cause barriers for passage and reduced refuge. The Chelan basin is predicted to remain a cool water refuge. **Fisheries Management** (2.2) <u>Angling/Harvest/ Poaching</u>. Fishing regulations and harvest rules need to continue protect bull trout. Illegal poaching occurring in several basins but is unknown within the Chelan and Columbia in the vicinity of the Chelan River. <u>Fisheries Management</u>. Increased fish management and need for monitoring causes increased handling impacts. Species interactions from hatchery fish and other non-native species are likely, degree of impact are unknown. **<u>Small Population Size</u>** (2.3) <u>Loss/Altered Migratory Life History</u>. Life histories have been altered due to long term impediment of fish passage at long time dams and diversions. Bull Trout have not been recently observed in Lake Chelan, but use the Chelan River and FMO habitat. Telemetry detected most bull trout visiting the Chelan Hatchery near the mouth of the Chelan River.	non-native species occur within FMO habitats and risk potential spread esp. as waters warm with climate change.

<u>Geographic Region</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS[1]**		
		Habitat	***Demographic***	***Nonnative***
		application of pesticides/herbicides affect adjacent fish habitat. <u>Climate Change</u>. Current science predicts changes will impact stream flow/ temperature, etc. The Chelan basin provides for cool water refuge.	<u>Fisheries Management</u>. Species interactions from hatchery released smolts may be greatest on low abundance populations and sub-adults. Need to understand food webs and predator-prey relationships. **Forage Fish Availability** (2.4) <u>Fish Passage/ Introduced Species/Fish management</u>. Columbia River hydropower dams, irrigation diversions, and legacy splash dams or other culverts currently or historically blocked passage for potential native prey species. Hatchery releases may both impact and benefit bull trout esp. where low numbers of bull trout exist. Lake and brook trout outcompete bull trout for habitat and food.	
Okanogan River FMO	**n/a**	**Upland/Riparian Land Management** (1.1) <u>Agriculture/Livestock Grazing/ Forest Management Practices</u>. Legacy and current practices including forest road management have resulted in a lack of habitat complexity (*i.e.*, wood, primary pools, functioning floodplains). Agriculture practices have channelized stream, impacted floodplains, and reduced riparian vegetation. <u>Development/Transportation Networks</u>. Legacy and current facilities and roads impact FMO habitat.	**Connectivity Impairment** (2.1) <u>Agriculture</u>. Irrigation diversions cause impacts to fish passage and entrainment. Some reaches have listed 303d listed reaches. Instream temperatures, DO, and chemicals have legacy and current impacts on habitat complexity, reducing connectivity of bull trout habitat. <u>Forest Management/ Transportation Networks</u>. Legacy and current forest roads/highways/county roads continue to impair connectivity for migration. Forest Management and Transportation Networks have impeded passage and contributed to a lack of complex habitat. <u>Entrainment (hydropower and</u>	**Nonnative Fishes** (3.1) <u>Introduced Species/Fish management</u>. Brook trout are non-native predators in the basin and could impact recovery. Brook trout overlap with bull trout in FMO habitat. Fisheries still occur on brook trout. Brook trout hybridize with bull trout. Salmon recovery involves output of high numbers of smolts, with some residualization and species competition which may have impacts to preybase for bull trout.

Geographic Region Core Area (Complex) *Core Area (Simple)*	Number of Local Populations	PRIMARY THREATS[1]		
		Habitat	***Demographic***	***Nonnative***
		Instream Impacts (1.2) Forest Management Practices/Transportation Networks. Legacy and current management actions have degraded habitat. Highways, railroad, and county roads adjacent to FMO areas and development reduces habitat complexity, creates passage issues, and degrades water quality. Altered Flows. Mainstem diversion dams, Zosel Dam and dams in Canada have altered instream flows and water quality. Entrainment and Connectivity/Fish Passage. Hydropower dams on the mainstem Columbia River irrigation dams, and historic splash dams altered channel structure. Water Quality Impairment. Both legacy and current management has led to 303d listed reaches with water quality degradation. Standards are frequently not met in FMO areas. Climate Change. Current science predicts temperature changes will impact stream flow and stream temperatures. Quality of the	diversions)/Fish Passage. Entrainment occurs at all hydropower and irrigation dams in the Okanogan River where fish passage is fully or partially blocked, causing altered movement patters for adults and subadults for forage, migration, and overwintering habitat. Climate Change. Climate change is predicted to impact stream flows and temperatures that will cause impede passage and reduced refuge. **Fisheries Management** (2.2) Angling/Harvest/Poaching. Fishing regulations and harvest rules need to be improved in some areas and need to continue to protect bull trout in other areas. It is a research need to understand if poaching occurs in the Okanogan FMO. Fisheries Management. Increased fish management and need for monitoring causes increased handling impacts. Species interactions from hatchery fish on small bull trout population are likely and the degree of impacts are unknown. Improve native species assemblages. **Small Population Size** (2.3) Loss/Altered Migratory Life History. Life histories have been altered due to long term impediment of fish passage at long time diversions in the Columbia and Okanogan Rivers and at hydropower dams, and splash dams. It is unknown if spawning exists in Washington or Canadian portion of the Okanogan River.	Climate Change. Predatory non-native species occur within FMO habitats and risk potential spread esp. as waters warm with climate change.

Geographic Region Core Area (Complex) *Core Area (Simple)*	**Number of Local Populations**	**PRIMARY THREATS[1]**		
		Habitat	***Demographic***	***Nonnative***
		FMO will be further degraded (stream temps, turbidity, sediments, dissolved oxygen).	Fisheries Management. Species interactions from hatchery released smolts and overlapping adult spanners may be greatest on low abundance populations. **Forage Fish Availability** (2.4) Fish Passage/Introduced Species/Fish management. Columbia and Okanogan River dams, irrigation diversions, and legacy splash dams or other culverts currently or historically block passage for potential native prey species. Hatchery releases may both impact and benefit bull trout esp. where low numbers of bull trout exist. Brook trout outcompete bull trout for habitat and food.	

Geographic Region **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS[1]**		
		Habitat	***Demographic***	***Nonnative***
Lower Snake Geographic Region				
South Fork Clearwater River	**5**	**Upland/Riparian Land Management** (1.1) Legacy impacts from forest practices, roads, and mining, as well as transportation corridors (historical and current) contribute to degradation in some SR tributaries and mainstem FMO habitat. Agricultural practices and improper grazing degrade habitat primarily in lower mainstem FMO habitat. **Instream Impacts** (1.2) Activities such as forest practices, mining, roads, and grazing in upland and riparian areas have contributed to instream degradation, loss of LWD, pool reduction, and sedimentation.	**None**	**Nonnative Fishes** (3.1) Brook trout in some SR tributaries (*e.g.*, upper Crooked and Red Rivers), and mainstem FMO habitats contributing to competition, predation, range reduction, and possible hybridization.
North Fork Clearwater River	**12**	**None**	**None**	**None**
Lochsa River	**17**	**None**	**None**	**None**
Selway River	**10**	**None**	**None**	**None**
Tucannon River	**5**	**Upland/Riparian Land Management** (1.1) Agricultural and forest practices, transportation networks, rural and urban development have eliminated or reduced riparian cover and protective buffers, resulting in the loss of habitat complexity, and increased water temperatures.	**Connectivity Impairment** (2.1) Thermal and manmade barriers prevent or limit free movement and connectivity between FMO and spawning/rearing areas. Hydropower facilities on the mainstem Snake River delay migration or hinder free movement of bull trout between core areas.	**Nonnative Fishes** (3.1) Predatory species such as small mouth bass and walleye in FMO areas of the lower Tucannon River and mainstem Snake River. Competitive/ interbreeding species including hatchery origin rainbow, and brook trout in FMO and

Geographic Region Core Area (Complex) *Core Area (Simple)*	Number of Local Populations	PRIMARY THREATS[1]		
		Habitat	***Demographic***	***Nonnative***
		Instream Impacts (1.2) Flood control and transportation networks that have led to channelization, loss of floodplain connectivity, levee installation and loss of habitat complexity and diversity throughout entire core area. **Water Quality** (1.3) Contaminants, sedimentation, and temperature impairments both from current and legacy agricultural, recreational, forestry, and transportation practices in the watershed have reduced habitat availability and suitability. Reduction of habitat suitability due to climate change is predicted as high risk in the core area.		spawning/rearing areas. Changes in habitat and water temperatures as a result of climate change will likely exacerbate this threat in some areas.
Asotin Creek	**1**	**Upland/Riparian Land Management** (1.1) Legacy impacts from residential development, agricultural practices, grazing, and recreation that reduce or limit habitat complexity, increase water temperatures and sediment loading, and reduce wood recruitment. **Instream Impacts** (1.2) Impacts from flood control and repairs, especially in lower stream reaches. Intermittent flows and dewatering throughout basin in tributaries impacting migration.	**Connectivity Impairment** (2.1) Seasonal manmade and temperature barriers to migration in Snake River and lower Asotin Creek prevent or hinder migratory life history. **Small Population Size** (2.3) Low population size and loss of fluvial migratory life history form have reduced genetic diversity and demographic stability.	**None**

Geographic Region **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS**[1]		
		Habitat	***Demographic***	***Nonnative***
		Naturally low instream flows and high temperatures accentuated by climate change.		
Upper Grande Ronde	**6**	**Upland/Riparian Land Management** (1.1) Livestock Grazing and Forest Management Practices, including forest roads, have resulted in a lack of large wood recruitment, loss of pools, sedimentation, warm water temperatures and low flows. **Instream Impacts** (1.2) Legacy Forest Management Practices, including splash damming, and Agricultural Practices, construction of the State Ditch, have channelized the river channel, reduced instream complexity, and increased water temperature and sedimentation in FMO habitats.	**Connectivity Impairment** (2.1) Temperature Barriers and Low Flows impede movement of bull trout between populations and in FMO habitats.	**None**
Wallowa/Minam	**6**	**Water Quality** (1.3) Agricultural Practices and other land use activities resulted in high water temperatures and low flows that degrade habitat quality and impede connectivity, particularly in FMO habitats.	**None**	**Nonnative Fishes** (3.1) Brook trout are present in all populations except Deer Creek and negatively impact bull trout through Hybridization and competition.
Little Minam	**1**	**None**	**None**	**None**
Lookingglass/ Wenaha	**4**	**None**	**None**	**None**

Geographic Region **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS[1]**		
		Habitat	***Demographic***	***Nonnative***
Imnaha River	**8**	**None**	**None**	**None**
Middle Snake Geographic Region				
Powder River	**10**	**Upland/ Riparian Land Management** (1.1) Agricultural practices, legacy forest management practices (including roads) and livestock grazing have resulted in high water temperatures, sedimentation, and loss of floodplain connection and instream complexity in bull trout habitats. **Instream impacts** (1.2) Agricultural practices and mining activities have degraded the stream channel and pose a risk of chemical contamination. **Water Quality** (1.3) Dewatering and high water temperatures as a result of intense land use activities mentioned above create inhospitable conditions for bull trout in FMO habitats during summer months. Increased water temperatures and loss of available habitat due to climate change are predicted as a high risk to this core area.	**Connectivity Impairment** (2.1) Fish passage issues and entrainment at dams, diversions, and culverts, as well as dewatering and temperature barriers impair connectivity between spawning populations and FMO habitats. **Small Population Size** (2.3) Small populations isolated in headwater streams are at high risk of genetic and demographic stochasticity and the loss of the migratory life history threatens persistence.	**Nonnative Fishes** (3.1) Hybridization and competition with brook trout are serious threats to bull trout. Brook trout are widespread and abundant throughout the core area.

<u>**Geographic Region**</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS[1]**		
		Habitat	***Demographic***	***Nonnative***
Pine/Indian/ Wildhorse	**3**	**Instream Impacts** (1.2) <u>Dewatering</u> caused by numerous diversions has resulted in significantly reduced stream flow and elevated stream temperatures directly impacting the migratory life history.	**Connectivity Impairment** (2.1) <u>Dewatering</u>, <u>entrainment</u> and <u>passage barriers</u> caused by water diversions and impeded connectivity. Oxbow and Hells Canyon Dams isolate Wildhorse Creek from other populations in the core area and prevent connection to other core areas.	**Nonnative Fishes** (3.1) <u>Hybridization</u> and <u>competition</u> with brook trout are serious threats to bull trout. Brook trout are widespread throughout the core area.
<u>**Mainstem Columbia and Snake Rivers**</u>				
Mainstem Columbia and Snake River FMO	**n/a**	**None**	**None**	**None**

[1] **Primary Threat**: *Primary threats are those factors known or likely (i.e., non-speculative) to negatively impact bull trout populations at the core area level, and accordingly require actions to assure bull trout persistence to a degree necessary that bull trout will not be at risk of extirpation within that core area in the foreseeable future (4 to 10 bull trout generations, approximately 50 years).*

Climate Change

Global climate change, and the related warming of global climate, have been well documented (IPCC 2007, ISAB 2007, WWF 2003). Evidence of global climate change/warming includes widespread increases in average air and ocean temperatures and accelerated melting of glaciers, and rising sea level. Given the increasing certainty that climate change is occurring and is accelerating (IPCC 2007, Battin *et al*. 2007), we can no longer assume that climate conditions in the future will resemble those in the past.

Patterns consistent with changes in climate have already been observed in the range of many species and in a wide range of environmental trends (ISAB 2007, Hari *et al*. 2006, Rieman *et al*. 2007). In the northern hemisphere, the duration of ice cover over lakes and rivers has decreased by almost 20 days since the mid-1800's (WWF 2003). The range of many species has shifted poleward and elevationally upward. For cold-water associated salmonids in mountainous regions, where their upper distribution is often limited by impassable barriers, an upward thermal shift in suitable habitat can result in a reduction in range, which in turn can lead to a population decline (Hari *et al*. 2006).

In the Pacific Northwest, most models project warmer air temperatures and increases in winter precipitation and decreases in summer precipitation. Warmer temperatures will lead to more precipitation falling as rain rather than snow. As the seasonal amount of snow pack diminishes, the timing and volume of stream flow are likely to change and peak river flows are likely to increase in affected areas. Higher air temperatures are also likely to increase water temperatures (ISAB 2007). For example, stream gauge data from western Washington over the past 5 to 25 years indicate a marked increasing trend in water temperatures in most major rivers.

Climate change has the potential to profoundly alter the aquatic ecosystems upon which the bull trout depends via alterations in water yield, peak flows, and stream temperature, and an increase in the frequency and magnitude of catastrophic wildfires in adjacent terrestrial habitats (Bisson *et al*. 2003).

All life stages of the bull trout rely on cold water. Increasing air temperatures are likely to impact the availability of suitable cold water habitat. For example, ground water temperature is generally correlated with mean annual air temperature, and has been shown to strongly influence the distribution of other chars. Ground water temperature is linked to bull trout selection of spawning sites, and has been shown to influence the survival of embryos and early juvenile rearing of bull trout (Rieman *et al*. in press). Increases in air temperature are likely to be reflected in increases in both surface and groundwater temperatures.

Climate change is likely to affect the frequency and magnitude of fires, especially in warmer drier areas such as are found on the eastside of the Cascade Mountains. Bisson *et al*. (2003) note that the forest that naturally occurred in a particular area may or may not be the forest that will be responding to the fire regimes of an altered climate. In several studies related to the effect of large fires on bull trout populations, bull trout appear to have adapted to past fire disturbances through mechanisms such as dispersal and plasticity. However, as stated earlier, the future may well be different than the past and extreme fire events may have a dramatic effect on bull trout and other aquatic species, especially in the context of continued habitat loss, simplification and fragmentation of aquatic systems, and the introduction and expansion of exotic species (Bisson *et al*. 2003).

Migratory bull trout can be found in lakes, large rivers and marine waters. Effects of climate change on lakes are likely to impact migratory adfluvial bull trout that seasonally rely upon lakes for their greater availability of prey and access to tributaries. Climate-warming impacts to lakes will likely lead to longer periods of thermal stratification and coldwater fish such as adfluvial bull trout will be restricted to these bottom layers for greater periods of time. Deeper thermoclines resulting from climate change may further reduce the area of suitable temperatures in the bottom layers and intensify competition for food (WWF 2003).

Bull trout require very cold water for spawning and incubation. Suitable spawning habitat is often found in accessible higher elevation tributaries and headwaters of rivers. However, impacts on hydrology associated with climate change are related to shifts in timing, magnitude and distribution of peak flows that are also likely to be most pronounced in these high elevation stream basins (Battin *et al*. 2007). The increased magnitude of winter peak flows in high elevation areas is likely to impact the location, timing, and success of spawning and incubation for the bull trout and Pacific salmon species. Although lower elevation river reaches are not expected to experience as severe an impact from alterations in stream hydrology, they are unlikely to provide suitably cold temperatures for bull trout spawning, incubation and juvenile rearing.

As climate change progresses and stream temperatures warm, thermal refugia will be critical to the persistence of many bull trout populations. Thermal refugia are important for providing bull trout with patches of suitable habitat during migration through or to make feeding forays into areas with greater than optimal temperatures.

There is still a great deal of uncertainty associated with predictions relative to the timing, location, and magnitude of future climate change. It is also likely that the intensity of effects will vary by region (ISAB 2007) although the scale of that variation may exceed that of States.

For example, several studies indicate that climate change has the potential to impact ecosystems in nearly all streams throughout the State of Washington (ISAB 2007, Battin *et al*. 2007, Rieman *et al*. 2007). In streams and rivers with temperatures approaching or at the upper limit of allowable water temperatures, there is little if any likelihood that bull trout will be able to adapt to or avoid the effects of climate change/warming. There is little doubt that climate change is and will be an important factor affecting bull trout distribution. As its distribution contracts, patch size decreases and connectivity is truncated, bull trout populations that may be currently connected may face increasing isolation, which could accelerate the rate of local extinction beyond that resulting from changes in stream temperature alone (Rieman *et al*. 2007). Due to variations in land form and geographic location across the range of the bull trout, it appears that some populations face higher risks than others. Bull trout in areas with currently degraded water temperatures and/or at the southern edge of its range may already be at risk of adverse impacts from current as well as future climate change.

For a more thorough discussion of climate change and potential impacts on bull trout, refer to the main text in the bull trout recovery plan.

Ongoing Mid-Columbia Recovery Unit Conservation Measures (Summary)

In the John Day River basin of Oregon, the U.S. Forest Service, Bureau of Reclamation, and BLM are working with private landowners and the Confederated Tribes of the Warm Springs on projects for road removal, channel restoration, mine reclamation, improved grazing management, removal of passage barriers, reductions in Forest road network impacts, and restoration of floodplains impacted by legacy dredge mining, all of which are actions that will benefit bull trout in all three core areas (North Fork, Middle Fork, and Upper Mainstem John Day core areas).

In the Asotin, Tucannon, Walla Walla, Touchet, Yakima, Wenatchee, Entiat, and Methow core areas in Washington, considerable progress has been made in eliminating fish passage barriers, reducing impacts at PUD mainstem Columbia River dams, improving riparian habitat conditions, and restoring salmon runs. Across the national forest most of the large culverts in spawning and rearing habitat have been replaced with wider, larger, open bottom arch culverts or bridges. In the Touchet River, Walla Walla River, and Mill Creek several projects screening irrigation ditches, consolidating ditches, and modifying diversion structures have been completed. In the Tucannon and Touchet rivers, the Tri-State Steelheaders, WDFW, and the Snake River Salmon Recovery Group have implemented many projects increasing wood, improving complexity, and reconnecting floodplains through levee removal or set-backs. A major fish ladder installed at Nursery Bridge near Milton Freewater facilitates passage of large salmon, steelhead, and bull trout. A settlement agreement signed by three local irrigation districts and the Service provides for maintenance of instream flows in a stretch of the Walla Walla River that had been seasonally dewatered by irrigation diversions. Additional actions that have been occurring in these core areas include restoration of stream habitat complexity, extensive road decommissioning, removal of levees, and changes in agricultural water use.

In the Clearwater River basin in Idaho, a variety of stream restoration projects have been implemented on Federal lands (Nez Perce-Clearwater National Forests, Bureau of Land Management) to benefit bull trout within the South Fork Clearwater River, North Fork Clearwater River, and Lochsa River core areas. For example, the Nez Perce Tribe has funded fish habitat restoration in the Lochsa River Core Area, in conjunction with a Forest Service land exchange with Western Pacific Timber properties. Additionally, the Forest Service and BLM have actively pursued restoration activities in the South Fork Clearwater River Core Area including the removal of culvert barriers on many tributaries (*e.g.*, East Fork American River) and habitat restoration (*e.g.*, Crooked River) through the placement of large woody debris, boulders, and other structures as well as riparian restoration (USFWS 2008a).

In the Yakima, Wenatchee, Entiat, Methow, and mainstem Columbia areas many actions have been implemented or are ongoing and involve continued monitoring in association with some of the large scale actions listed below. Culverts have been replaced on major salmon and bull trout spawning areas some by bridges (*i.e.*, Deep Creek in the Yakima). U.S. Forest Service grazing allotments in areas of spawning have included ongoing management plans with the help of permitees to reduce trampling of redds, sedimentation, improve riparian areas, etc. (*i.e.*, Twisp, Beaver, Goat in the Methow; Tributaries in the Mad and Entiat Rivers; and Teanaway, South Fork Tieton, Naches basins in the Yakima). The Department of Natural Resources continues to monitor grazing in Ahtanum Creek in association with resource conservation plans in spawning areas. Fishing regulation and fish stocking has been further changed since listing to reduce impact on some populations of bull trout and future monitoring efforts will serve to improve them further. Fish irrigation diversions and instream flows in the Methow have incrementally improved since listing. Hydrologic permit approvals from WDFW continue to improve and assist work in the channel associated with construction or development. Fish screening criteria has been improved in most basins and incurs ongoing maintenance. Ongoing bull trout conservation is occurring because of the Grant, Chelan, and Douglas County Public Utility Districts (PUDs) Federal Energy Regulatory Commission (FERC) relicensing biological opinion, settlement agreements, and bull trout management plans for the continued operation and maintenance of PUD operated Columbia River dams and associated activities, the PUD Habitat Conservation Plans and Tributary funds projects, and the implementation of the biological opinion for the Leavenworth National Fish Hatchery. Future conservation is expected to occur through section 7 consultation under the Act with BOR for the Yakima Irrigation Ongoing Operations and Maintenance Project. In addition, the Yakima Basin Bull Trout Action Plan and upper Columbia salmon recovery planning documents list many other actions that have been implemented in foraging, migration, and overwintering areas that will improve conditions for bull trout (*i.e.*, fish screens and passage features for anadromous species at Yakima, Naches, Toppenish, and Ahtanum diversions in FMO habitat).

Other large scale ongoing actions that are implemented as a result of terms and conditions from a section 7 Biological Opinion, or are specifically designed for recovery of bull trout or other salmonids, can benefit bull trout. The Idaho Department of Lands along with other non-Federal forest land managers have implemented modern forest practices that have contributed to improved bull trout habitat conditions and distribution. Since at least 1986, under the Idaho Forest Practices Act and the Stream Channel Protection Act, all stream crossings on fish bearing streams must provide for fish passage. The Idaho Forest Practices Act, Title 38, Chapter 13, Idaho Code, pertaining to road construction, reconstruction, and maintenance (Rule 040) states: Culvert installations on fish bearing streams must provide for fish passage. Specific guidelines are found in the Rules Pertaining to Stream Channel Alteration, Title 37, Chapter 03, Idaho Code. Idaho Department of Lands actively replaces fish barriers and over the last 10 years has replaced 91 fish blocking culverts with fish passable structures in the Mid-Columbia Recovery Unit.

Other ongoing actions span across multiple recovery units and include implementation of the Northwest Forest Plan, Pacific Anadromous Fish Strategy/Inland Fish Strategy (PACFISH/INFISH) and associated Aquatic Conservation Strategy objectives, consultations on EPA’s approval of State temperature standards, various habitat conservation plans and associated biological opinions, and the Federal Columbia River Power System (FCRPS) biological opinion and ongoing work with Federal power operators to minimize impacts to bull trout. In addition, significant recovery actions are being implemented across the Mid-Columbia Recovery Unit for salmon and steelhead with direct benefits to bull trout (*e.g.*, habitat restoration, fish passage, etc.). Bull trout in many Washington core areas have also benefited from improved forestry management reducing impacts on aquatic and riparian systems, resulting from implementation of the 2006 Washington State Forest Practices HCP with the Washington Department of Natural Resources.

Research, Monitoring, and Evaluation

Given the size of the Mid-Columbia RU, and the variable attention to bull trout across the unit, it is challenging to summarize the type and level of population monitoring across the unit. There is no standardized bull trout monitoring program or guidance for bull trout that is implemented across the landscape. Some basins, such as the Walla Walla and Touchet Rivers and Lookingglass Creek, have been intensively monitored resulting in long-term datasets that allow for current assessment of status and trend. More common however is sporadic monitoring or information collected incidental to monitoring other species like salmon. Many core areas in the Mid-Columbia RU, such as all three of the core areas in the John Day, the Minam, and Upper Grande Ronde have had little to no monitoring for many years and the status of bull trout in these basins is uncertain. The specific core area narratives and implementation schedules below identify research, monitoring, and evaluation needs and prioritize those needs relative to the current level of information available for bull trout in those specific core areas. It is clear that a greater emphasis needs to be made on standardizing monitoring and evaluation of bull trout populations across this recovery unit in order to develop sufficient demographic information to assess status and trend, and response to recovery actions.

Recovery Measures Narrative

The recovery measures narrative for each core area within the Mid-Columbia Recovery Unit is structured in a hierarchical step-down narrative under which specific recovery actions are grouped and listed to address identified primary threats. We established three broad primary threat category classifications (Habitat, Demographic, and Non-Natives) which were further subdivided into more specific second tier threat categories where applicable:

- Habitat – Upland/Riparian Land Management, Instream Impacts, and Water Quality
- Demographic – Connectivity Impairment, Fisheries Management, Small Population Size, and Forage Fish Availability
- Nonnatives – Nonnatives

Specific recovery actions are each listed under a third tier of individual threat descriptors which were developed to more specifically characterize these second-tier threat categories for that particular core area. If a second-tier threat category is not applicable to a particular core area, no third-tier threats are listed in the narrative and the second-tier threat is gray-shaded. Core areas, Shared FMOs, and their specific recovery actions have been grouped by the four major geographic regions shown in Table C-1 above. In addition to third-tier recovery actions that address identified primary threats, we also identified and listed additional conservation recommendations within the recovery measures narrative. These actions are considered beneficial for bull trout conservation and merit implementation, but do not address primary threats and are not considered necessary to meet recovery objectives within a core area.

Lower Mid-Columbia Geographic Region

North Fork John Day River Core Area

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

Forest Management and Agricultural Practices

1.1.1 Restore shade and canopy, riparian cover, and native vegetation in all bull trout spawning, rearing and migration areas. Priority sites include portions of the North Fork John Day River, including Desolation and Granite creek watersheds. Use the John Day Basin TMDL and Water Quality Restoration Plan, BPA Subbasin Assessments, and Forest Service Watershed Analyses to prioritize activities.

1.1.2 Identify and reduce sources of excessive fine sediment delivery. Stabilize roads, crossings, and other sources of sediment delivery; remove and vegetatively restore unneeded roads. Crossings such as those in Onion, Deep, Boulder, and South Fork Trail Creeks need to be upgraded. Other roads and crossings across the basin may need to be modified, or closed to reduce sediment.

Mining

1.1.3 Improve degraded instream conditions associated with legacy mining and extraction. Remove or reduce mining impacts on North Fork John Day, Granite Creek and Clear Creek. Remove sources and/or stabilize effluent from mine shafts in the Granite/Clear Creek system. Reduce impacts of sedimentation and channelization related to mineral extraction. Require full implementation of mitigation for mining activities on Federal land. Evaluate mitigation measures over time to see if they are meeting the needs of the resource.

Livestock Grazing

1.1.4 Reduce grazing impacts. Fencing, changes in timing, and the use of riparian pastures, off site watering and salting, and other measures can be used to minimize grazing impacts. Federal land management agencies should fully implement PACFISH/INFISH standards and guidelines for livestock grazing, as appropriate. Evaluate ongoing allotment management for effects to bull trout and bull trout critical habitat. Modify management as needed, to reduce or eliminate effects that would retard recovery of bull trout populations and/or bull trout designated critical habitat. Conduct implementation and effectiveness monitoring, using accepted interagency monitoring protocols currently in use in the North Fork John Day Basin. Apply monitoring results to modify allotment management as necessary.

1.2. Instream Impacts

1.2.1 Conduct stream channel and floodplain restoration activities. Review habitat information to identify and prioritize opportunities for channel restoration. Full floodplain (*e.g.*, hillslope toe to hillslope toe) restoration is necessary to effectively address limiting factors and processes related to the reduction of water temperature and increased hyporheic flow connectivity that provides buffering temperature affects annually and reduces variance of daily temperature fluxes. Design and implement projects where warranted and cost effective. Continue redistribution of dredge tailing piles in parts of the North Fork John Day River and the Clear Creek system to restore a more natural stream channel cross- section and flood plain access for the stream; address impacts of historic mine activity in North Fork Granite, Trail and Crane Creeks. Repair head cut at Haystack Meadows. Assess feasibility of relocating the county road from the middle of the Clear Creek floodplain in order to consolidate late-season flows in the main channel and restore surface flow connectivity and flow depth in Clear Creek sufficient to allow fish passage upstream and downstream year round.

Mining

1.2.2 Minimize impacts of load, placer and suction dredge mining to bull trout and their habitats. Implement the Terms and Conditions in the Service's Biological Opinion on Load, Placer, & Suction dredge mining in the Granite Creek watershed (USFWS 2015c, draft). The Terms and Conditions outline measures required to avoid bull trout, minimize effects to habitat, both instream and upland/riparian, and monitor implementation and effectiveness. Use these measures as recommendations and guidelines for mining activity elsewhere in the North Fork John Day River watershed.

1.2.3 Provide a reliable source of large hardwood beaver forage. Beaver have disappeared from much of their historical range. Beavers initiate and maintain critical watershed processes important to water retention, sediment sequestration, cold water storage, and floodplain connectivity. The reestablishment of these processes in the riverscape is critical to the recovery of bull trout and their habitat. The current lack of hardwoods in riparian habitats and the necessary structure to support beaver dam construction are one of the factors limiting the recolonization of Granite Creek by beaver. Implement activities to encourage riparian shrub and hardwood communities to re-establish in an effort to encourage beaver to naturally recolonize and restore the riverscape. Consider providing large wood support material to jump start beaver dam construction.

1.2.4 Evaluate and implement actions to encourage beaver recolonization. To assist in re-establishing functional riparian communities, Federal, Tribal and State resource agencies should identify and implement measures to increase beaver abundance where feasible and biologically supportable. Reduction in beaver trapping pressures, increase in active releases, and utilization of beaver control structures should be considered where effective and appropriate.

1.3. Water Quality

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

Fish Passage Issues

2.1.1 Install appropriate fish passage structures around diversions and/or remove migration barriers wherever appropriate. Ensure all diversions are fish friendly including combining diversions, converting to a pump/infiltration gallery, and installing adjustable headgates, water measuring devices, and efficient ditches (low flow loss via seepage or breaching). Repair, replace or modify culverts, or other structures that act as barriers to fish passage. Maintain and monitor the improved fish passage structures. Assess and restore where feasible low-flow connectivity at tributary confluences such as at Bull Run Creek.

2.1.2 Improve and secure instream flows. Increased instream flow is a necessary condition to improving water quality and decreasing stream temperature and plays a critical role in reducing long-term impacts from climate change. Restore connectivity and opportunities for migration by securing instream flows and/or water rights. Develop an inventory of water rights that may be reallocated for the benefit of bull trout and other salmonids. Secure water rights through purchase or lease. Improve irrigation efficiencies and allow conserved water to be used for instream purposes. Reduce diversions where necessary and feasible. Priority areas include Pete Mann ditch, which intercepts Lightning Creek, Salmon Creek, Spring Creek, and upper Clear Creek flows.

Entrainment

2.1.3 Install appropriate fish screens at diversions irrigation ditches to prevent the entrainment of fish into irrigation systems. Screening at the Pete Mann Ditch on Clear Creek is high priority.

Temperature Barriers

2.1.4 Reduce or eliminate thermal barriers by maintaining or improving riparian vegetation communities providing shade to streams. Current juvenile and adult bull trout distribution is impeded by thermal barriers among spawning and FMO habitats. Efforts should be made to reduce thermal barriers through actions detailed in section 1.1.

2.2. Fisheries Management

2.3. Small Population Size

2.4. Forage Fish Availability

3. Actions to Address Nonnative Fishes

3.1 Nonnative Fishes

Hybridization & Competition

3.1.1 Evaluate presence/absence of introduced fishes in bull trout habitat Determine the distribution of bull trout, brook trout, and hybrids in the upper North Fork John Day River and tributaries, and Desolation Creek.

3.1.2 Assess severity of threat due to hybridization with brook trout where the two species co-occur in the North Fork John Day.

3.1.3 Implement nonnative species removal efforts wherever feasible and biologically supportable. Remove or eradicate brook trout from lakes that drain into bull trout streams in the upper North Fork John Day River.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.2.1 Assess current status of resident and migratory bull trout in the North Fork John Day core area. Monitoring efforts in recent years have diminished and the current picture of status in the core areas is vague at best. The unknown status of bull trout is a critical uncertainty for the North Fork John Day Core Area. Emphasis should be placed on defining distribution and describing where populations exist.

4.2.2 Develop a long term monitoring program to assess status and trend of bull trout in the North Fork John Day Core Area. Collaborate with partners to develop a rigorous and cost effective monitoring plan capable of detecting change in demographic metrics and effectiveness of recovery efforts. Coordinate with efforts to develop a region-wide monitoring plan.

4.2.3 Identify local populations in the North Fork John Day Core Area. Conduct a genetic analysis using previously collected samples to define population and metapopulation structure in the North Fork John Day Core Area along with Upper Mainstem and Middle Fork John Day. If distribution and occupancy surveys show bull trout in locations where genetic samples were not originally collected, ensure these new location are included in the analysis.

4.2.4 Further define bull trout distribution and habitat use in the North Fork John Day River Core Area. For example, identify existing spawning habitat for bull trout populations in Desolation Creek (North Fork John Day River) and its tributaries, and determine movement of fluvial bull trout originating in the core area.

4.3 Nonnatives

4.3.1 Monitor the distribution of brook trout and hybridization rates within the North Fork John Day basin.

Conservation Recommendations

- Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist. While working groups may be facilitated by any interested stakeholder, most often they are organized and facilitated by the Service, a State agency, U.S. Forest Service, or a Tribal entity. Although the Service has no guidelines for format or process, existing working groups are largely informal, are organized at various scales (*e.g.*, core area, river basin, geographic region, or recovery unit) and generally meet at least annually.

- Provide long-term habitat protection through purchase from willing sellers, conservation easements. Potential candidates include lower Desolation Creek. Recovery tasks should emphasize private lands. Federal land management may already be protective of the majority of spawning habitat.

Middle Fork John Day River Core Area

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

Legacy Forest Management Practices & Livestock Grazing

1.1.1 Restore shade and canopy, riparian cover, and native vegetation in all bull trout spawning, rearing and migration areas. Priority sites include Deadwood Creek, Middle Fork John Day River; Pizer Meadow, Reynolds Meadow, Phipps Meadow, Lost and Pizer Creek confluence meadow; and migratory habitat on Federal and private lands of the Middle Fork John Day River and Big Creek. This component is vital to restoring not only shade but also natural hydrologic processes and function.

1.1.2 Conduct stream channel and floodplain restoration activities. Review habitat information to identify and prioritize opportunities for channel restoration. Full floodplain (*e.g.*, hillslope toe to hillslope toe restoration) is necessary for reduction of water temperature and increased hyporheic flow connectivity that provides buffering temperature affects annually and reduces variance of daily temperature fluxes. Design and implement projects where warranted and cost effective. Restore stream channel processes and floodplain connectivity within Deadwood Creek, Big Creek, Lost Creek, Pizer Creek, Bear Creek, Middle Fork John Day, Vinegar Creek, and Butte Creek through large and coarse wood additions. Restore water storage capacity within the meadows of Pizer, Armstrong, and Reynolds Meadow and Middle Fork John Day River.

1.1.3 Reduce grazing impacts. While recognizing that no livestock grazing would likely achieve recovery of habitat and populations more rapidly, the following measures would allow for livestock grazing occurring while habitat and populations recover at less than a near-natural rate of recovery.

Livestock grazing within riparian areas proximate to bull trout critical habitat should be limited to light utilization and minimal bank disturbance. Based on current and best available science, threshold indicators should be monitored utilizing the Multiple Indicator Monitoring Method (Burton *et al*. 2011) and threshold indicators when measured for early to mid-season should not exceed:

Indicator	Foraging / Migration / Overwintering	Spawning / Rearing	Comments
Bank Alteration	Less than 20%	Less than 15%	• Monitor within a week of the cows coming off the pasture. • Burton *et al*. 2011 • Bengeyfield 2006
Stubble Height*	6" (Early season) 8" (Late season)	8" (Early season) 10" (Late season)	• Goss 2013 • Clary and Webster 1989
Browse	Light (21 to 40%)	Slight (0 to 20%)	• Burton *et al*. 2011

* typical guidelines, early season is usually defined as the beginning of the growing season to mid-July and late season from mid-August to the end of the growing season.

To further aid in the recovery of bull trout and minimize the potential for redd trampling no livestock grazing should occur within sections of streams that are designated as Spawning/Rearing (USFWS 2010) after August 15 to the following spring. By removing livestock use after August 15 this should also aid in the recovery of woody shrubs which provide shade and stability to stream channels. These streams include Deadwood Creek (Big Creek), Big Creek, Butte Creek, Clear Creek, Vinegar Creek, Big Boulder Creek, Davis Creek, Bridge Creek, Granite Boulder Creek, and the Middle Fork John Day River. Special emphasis should be placed on restoring these tributaries to support bull trout.

In conjunction with the above; other measures can be used to minimize grazing impacts which include fencing, changes in timing, rest, rest rotation, off site watering and salting. Federal land management agencies should implement PACFISH/INFISH standards and guidelines for livestock grazing, as appropriate. Priority sites within the John Day River include the following Federal allotments; Bear Creek allotment, Slide Creek allotment, Lower Middle Fork John Day allotment, Camp Creek allotment, Upper Middle Fork John Day Allotment, Blue Mountain Allotment, and Sullens, all of which have some stream temperature, riparian habitat, and channel complexity problems.

1.1.4 Curtail unauthorized livestock use on USFS property. Implement regulations designed to reduce and eliminate violations of grazing permits and unauthorized grazing. Any cattle, sheep, goat, hog, or equine not considered wild and free roaming grazing without a permit is considered unauthorized by 36 CFR 222.20(b)(13).

Mining

1.1.5 Improve degraded instream conditions associated with legacy mining and timber extraction. Remove or reduce legacy mining and railroad logging impacts on MFJD, Big Creek, Butte Creek, Vinegar Creek, and Bridge Creek within the MFJD Core Area. Reduce/remove impacts of sedimentation, and channelization related to mineral and timber extraction. Require full implementation of mitigation for mining activities on Federal land. Evaluate mitigation measures over time to see if they are meeting the needs of the resource. The removal/reduction of the impacts of legacy mining and legacy railroad grade confinement is considered a high priority by the Recovery Unit Team.

1.1.6 Restore the Middle Fork John Day River to a natural channel in the vicinity of Galena within the dredge mine tailings and reconnect Bear Creek to the Middle Fork John Day.

1.2. Instream Impacts

1.3. Water Quality

1.3.1 Implement actions that support the TMDL and Water Quality Management and Restoration plans to achieve water quality objectives. Temperature and sedimentation are the most pressing water quality issues affecting bull trout. The John Day Basin Total Maximum Daily Load and Water quality management plan was completed November 2010. The John Day Water Quality Restoration Plan was completed in September 2014. Follow recommendations cited in the Plan to restore water quality.

1.3.2 Improve and secure instream flows. Increased instream flow is a necessary condition to improving water quality and decreasing stream temperature and plays a critical role in reducing long-term impacts from climate change. Develop an inventory of water rights that may be reallocated for the benefit of bull trout and other salmonids. Secure water rights through purchase or lease. Improve irrigation efficiencies and allow conserved water to be used for instream purposes. Reduce diversions where necessary and feasible. Implement riparian and channel restoration actions as identified in section 1.1. Benefits of stream channel restoration will include raising the water table, restoring natural instream flow and providing higher flows during summer and late fall.

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

Passage Issues

2.1.1 Install passage structures around diversions and/or remove related migration barriers. Address structures such as log weirs, culverts, and other legacy structures that block juvenile and adult passage to reconnect spawning, rearing and overwinter habitats. Repair, replace or modify culverts, or other structures that act as barriers to fish passage. Maintain and/ or improve fish passage structures associated with Bates Pond. Remove log weir juvenile fish passage barriers within Butte Creek and Clear Creek.

Thermal Barriers

2.1.2 Reduce or eliminate thermal barriers by maintaining or improving riparian vegetation communities providing shade to streams. Current juvenile and adult bull trout distribution is impeded by thermal barriers among spawning and rearing habitats, specifically in the Middle Fork John Day River. Efforts should be made to reduce thermal barriers through actions detailed in section 1.1 and 1.3. Also any diversion or runoff warmer than the receiving water should be cooled when possible before allowing it to enter the receiving system (*e.g.*, through subterranean pipes).

2.2. Fisheries Management

2.3. Small Population Size

We expect the implementation of the actions identified in this recovery plan will be sufficient to increase population size and maintain gene flow among populations and therefore ameliorate any deleterious effects of genetic and demographic stochasticity in addition to recovering the migratory life history type. Additional measures, such as population augmentation or reintroduction within historical distribution, should be considered in the event a demographic response to these actions is not observed.

2.4. Forage Fish Availability

3. Actions to Address Nonnative Fishes

None

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.2.1 Assess current status of resident and migratory bull trout in the Middle Fork John Day Core Area. Monitoring efforts in recent years have diminished and the current picture of status in the core areas is vague at best. The unknown status of bull trout is a critical uncertainty for the Middle Fork John Day Core Area. Better define spawning and rearing distribution.

4.2.2 Develop a long term monitoring program to assess distribution, status and trend of bull trout in the Middle Fork John Day Core Area. Collaborate with partners to develop a rigorous and cost effective monitoring plan capable of detecting change in demographic metrics and effectiveness of recovery efforts. Coordinate with efforts to develop a region-wide monitoring plan.

4.2.3 Conduct a genetic analysis to define population and metapopulation structure in the Middle Fork John Day Core Area. Conduct a genetic analysis using previously collected samples to define population and metapopulation structure in the Middle Fork John Day Core Area.

4.3 Nonnatives

Conservation Recommendations

- Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist. While working groups may be facilitated by any interested stakeholder, most often they are organized and facilitated by the Service, a State agency, U.S. Forest Service, or a Tribal entity. Although the Service has no guidelines for format or process, existing working groups are largely informal, are organized at various scales (*e.g.*, core area, river basin, geographic region, or recovery unit) and generally meet at least annually.

- Assess and address threat of sediment sources in Middle Fork John Day Basin affecting bull trout. Stabilize roads, crossings, and other sources of sediment delivery; remove and vegetatively restore unneeded roads such as the 2090 Road on Big Creek. Road closures need to be completed in the areas of Vinegar and Big Creeks in the Middle Fork John Day Core Area. Other roads and crossings across the basin may need to be modified, or closed to reduce sediment.

- Install appropriate fish screens at diversions to prevent the entrainment of fish into irrigation systems. High priorities for screening include diversions on Bridge Creek, Vinegar Creek, and Big Boulder Creek.

- Provide long-term habitat protection through purchase from willing sellers, and development of conservation easements. Potential candidates include the four or five remaining privately-held parcels in the Middle Fork John Day River corridor including lower Big Creek.

Upper Mainstem John Day River Core Area

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

Agricultural Practices & Livestock Grazing

1.1.1 Restore shade and canopy, riparian cover, and native vegetation in all bull trout spawning, rearing and migration areas. Indian, Reynolds, and Rail Creeks and the Upper John Day River have suppressed woody vegetation and loss of effective shade. This component is vital to restoring not only shade but also natural hydrologic processes and function.

1.1.2 Review habitat information to identify and prioritize opportunities for channel restoration in Indian Creek, Reynolds Creek (including the North Fork), Deardorff Creek, Rail Creek, Roberts Creek, Call Creek, and Upper John Day River. Design and implement projects based on findings.

1.1.3 Reduce grazing impacts. While recognizing that no livestock grazing would likely achieve recovery of habitat and populations more rapidly, the following measures would allow for livestock grazing occurring while habitat and populations recover at less than a near-natural rate of recovery. Livestock grazing within riparian areas proximate to bull trout critical habitat should be limited to light utilization and minimal bank disturbance. Based on current and best available science, threshold indicators should be monitored utilizing the Multiple Indicator Monitoring Method (Burton *et al*. 2011) and threshold indicators when measured for early to mid-season should not exceed:

Indicator	Foraging / Migration / Overwintering	Spawning / Rearing	Comments
Bank Alteration	Less than 20%	Less than 15%	• Monitor within a week of the cows coming off the pasture. • Burton *et al*. 2011 • Bengeyfield 2006
Stubble Height*	6” (Early season) 8” (Late season)	8” (Early season) 10” (Late season)	• Goss 2013 • Clary and Webster 1989
Browse	Light (21 to 40%)	Slight (0 to 20%)	• Burton *et al*. 2011

* typical guidelines, early season is usually defined as the beginning of the growing season to mid-July and late season from mid-August to the end of the growing season.

To further aid in the recovery of bull trout and minimize the potential for redd trampling no livestock grazing should occur within sections of streams that are designated as Spawning/Rearing (USFWS 2010) after August 15 to the following spring. By removing livestock use after August 15 this should also aid in the recovery of woody shrubs which provide shade and stability to stream channels. These streams include Indian Creek, Reynolds Creek (including the North Fork), Deardorff Creek, Rail Creek, Roberts Creek, Call Creek, and Upper John Day River. Special emphasis should be placed on restoring these tributaries to support bull trout. Habitat for bull trout on private lands of Indian Creek, Reynolds Creek, Deardorff Creek, Roberts Creek, and Upper John Day River are also degraded from historic and current livestock grazing.

In conjunction with the above; other measures can be used to minimize grazing impacts which include fencing, changes in timing, rest, rest rotation, off site watering and salting. Federal land management agencies should implement PACFISH/INFISH standards and guidelines for livestock grazing, as appropriate. Priority sites within the John Day River include the following Federal allotments; Deardorff Allotment, Hot Springs Allotment, Reynolds Creek Allotment, and Rail Allotment, all of which have some stream temperature, riparian habitat, and or channel complexity problems.

1.1.4 <u>Curtail unauthorized livestock use on USFS property</u>. Implement regulations designed to reduce and eliminate violations of grazing permits and unauthorized grazing. Any cattle, sheep, goat, hog, or equine not considered wild and free roaming grazing without a permit is considered unauthorized by 36 CFR 222.20(b)(13).

1.1.5 <u>Evaluate and implement actions to encourage beaver recolonization</u>. Beaver have disappeared from much of their historical range. Beavers initiate and maintain critical watershed processes important to water retention, sediment sequestration, cold water storage, and flood plain connectivity. The re-establishment of these processes in the riverscape is critical to the recovery of bull trout and their habitat. The current lack of hardwoods in riparian habitats and the necessary structure to support beaver dam construction are one of the factors limiting the recolonization of the Upper John Day River by beaver. Grazing pressure on riparian communities is detrimental to re-stablishing these critical riparian hardwoods. Implement activities to encourage riparian shrub and hardwood communities to re-establish in an effort to encourage beaver to naturally recolonize and restore the riverscape. Consider providing large support material to jump start beaver dam construction, reducing beaver trapping pressures, increasing active releases, and using beaver control structures if and where necessary.

1.2. Instream Impacts

1.3. Water Quality

1.3.1 Implement actions that support The TMDL and Water Quality Management and Restoration plans to achieve water quality objectives. Temperature and sedimentation are the most pressing water quality issues affecting bull trout. The John Day Basin Total Maximum Daily Load and Water quality management plan was completed November 2010. The John Day Water Quality Restoration Plan was completed in September 2014.

1.3.2 Improve and secure instream flows. Increased instream flow is a necessary condition to improving water quality and decreasing stream temperature. Develop an inventory of water rights that may be reallocated for the benefit of bull trout and other salmonids. Secure water rights through purchase or lease. Improve irrigation efficiencies and allow conserved water to be used for instream purposes. Reduce diversions where necessary and feasible, targeting lower Indian Creek where the stream often goes dry in mid-July. Implement riparian and channel restoration actions as identified in section 1.1. Benefits of stream channel restoration will include raising the water table, restoring natural instream flow and providing higher flows during summer and late fall.

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

Entrainment

2.1.1 Install appropriate fish screens at diversions to prevent the entrainment of fish into irrigation systems.

Passage Issues

2.1.2 Install passage structures around diversions and/or remove related migration barriers. Indian Creek is a high priority area with several dams in the lower 6 kilometers (km) (4 miles). Encourage landowner participation in programs to replace push-up dams with permanent passable dams.

2.1.3 Identify and remove structures such as log weirs, culverts, and other legacy structures that block juvenile and adult passage to reconnect spawning, rearing and overwinter habitats. Update inventory of culverts within bull trout distribution that create passage issues and replace, repair or modify those that are completely or partially impassable. Deardorff and Indian Creeks and the Upper John Day River are areas of concern.

Temperature Barriers

2.1.4 Reduce or eliminate thermal barriers by maintaining or improving riparian vegetation communities providing shade to streams, including non-bull trout bearing streams. Current juvenile and adult bull trout distribution is impeded by thermal barriers among spawning and rearing habitats, specifically in the Upper John Day River downstream of Prairie City. Efforts should be made to reduce thermal barriers through actions detailed in section 1.1 and 1.3. Also any diversion or runoff warmer than the receiving water should be cooled when possible before allowing it to enter the receiving system (*e.g.*, through subterranean pipes).

2.2. Fisheries Management

2.3. Small Population Size

We expect the implementation of the actions identified in this recovery plan will be sufficient to increase population size and maintain gene flow among populations and will ameliorate any deleterious effects of genetic and demographic stochasticity in addition to recovering the migratory life history type. Additional measures, such as population augmentation or reintroduction within historical distribution, should be considered in the event a demographic response to these actions is not observed.

2.4. Forage Fish Availability

3. Actions to Address Nonnative Fishes

None

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.2.1 Assess current status of resident and migratory bull trout in the Upper Mainstem John Day Core Area. Monitoring efforts in recent years have diminished and the current picture of status in the core areas is vague at best. The unknown status of bull trout is a critical uncertainty for the Upper John Day Core Area.

4.2.2 Develop a long term monitoring program to assess distribution, status and trend of bull trout in the Upper Mainstem John Day Core Area. Collaborate with partners to develop a rigorous and cost effective monitoring plan capable of detecting change in demographic metrics and effectiveness of recovery efforts. Coordinate with efforts to develop a region-wide monitoring plan.

4.2.3 Identify local populations in the Upper Mainstem John Day. Population structure in the Upper John Day Core Area is uncertain. Even though two populations are identified, Indian Creek and Upper John Day, the Upper John Day population likely consists of more than one. Conduct a genetic analysis using previously collected samples to define population and metapopulation structure in the Upper John Day Core Area.

4.3 Nonnatives

Conservation Recommendations

- Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist. While working groups may be facilitated by any interested stakeholder, most often they are organized and facilitated by the Service, a State agency, U.S. Forest Service, or a Tribal entity. Although the Service has no guidelines for format or process, existing working groups are largely informal, are organized at various scales (*e.g.*, core area, river basin, geographic region, or recovery unit) and generally meet at least annually.

- Monitor the distribution of brook trout in the Upper John Day Core Area. Brook trout are present in the Mainstem John Day River near Little Meadow, but are not abundant. Determine the distribution of brook trout, bull trout, and possible hybrids periodically to detect possibly expansion of brook trout distribution. Control or eradicate brook trout if necessary.

- Assess and address threat of sediment sources in Upper John Day Basin affecting bull trout. Identify road-related sediment problem areas in the John Day River Core Area, particularly in Reynolds, Deardorff, Roberts and Call Creeks and the John Day River. Examine the ways roads capture and channel runoff, and changes in surface runoff associated with soil compaction. Stabilize roads, crossings, railroad grades, and other sources of sediment delivery; remove and vegetatively restore unneeded roads and railroad grades.

Umatilla River Core Area

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

Livestock Grazing & Agricultural Practices

1.1.1 Protect and, where needed, revegetate riparian zones in areas used by bull trout. Consider incentives to encourage landowners and land management agencies to improve riparian conditions.

1.1.2 Reduce grazing impacts. Reduce grazing impacts. Fencing, changes in timing, and the use of riparian pastures, off site watering and salting, and other measures can be used to minimize grazing impacts. Federal land management agencies should fully implement PACFISH/INFISH standards and guidelines for livestock grazing, as appropriate. Evaluate ongoing allotment management for effects to bull trout and bull trout critical habitat. Modify management as needed, to reduce or eliminate effects that would retard recovery of bull trout populations and/or bull trout designated critical habitat. Conduct implementation and effectiveness monitoring, using accepted interagency monitoring protocols currently in use in the Umatilla River Basin. Apply monitoring results to modify allotment management as necessary.

1.1.3 Reduce unauthorized livestock use on National Forest lands by putting greater emphasis on enforcement of livestock grazing regulations. Key areas include North Fork Meacham Creek and East Meacham Creek.

1.2. Instream Impacts

Agriculture Practices

1.2.1 Restore floodplain function and channel complexity (*e.g.*, sinuosity) in areas utilized by bull trout. Review habitat information to identify and prioritize opportunities for stream restoration. For example, pulling back the dike on the Umatilla River downstream of Pendleton and altering the dike in the mainstem Meacham Creek would improve channel complexity and improve fish habitat and potential use by bull trout. Explore the use of incentives to encourage these types of actions.

1.2.2 Improve instream habitat complexity. Restoration activities should focus on: increasing instream habitat complexity, off-channel habitat, and high flow refugia by adding large wood; managing riparian areas for a future supply of large wood, adequate shade, and diverse allochthonous inputs; and reducing fine sediment and water quality impacts from intense land use activity.

1.2.3 Increase instream flows in areas occupied by bull trout. Promote use of Conserved Water Program (OWRD), Trust Water Rights Program (WDNR), programs of the Oregon Water Trust, the Oregon Water Resources Department upriver management program for the Umatilla, and irrigation district water conservation activities. Work with towns, cities, and counties to address water conservation to increase instream flows. Implement methods to protect conserved water instream.

1.2.4 Reduce, prevent, and minimize development in floodplains. Work with City and County agencies to reduce or eliminate development of floodplain areas for any purpose except to dissipate flood water and energy or to perform restoration activities. Where possible, restore floodplain connectivity, remove or set-back levees, and increase off channel areas. Identify potential development concerns (*e.g.*, conversions of farms/ranches to subdivisions) to county and city land use planning entities. Provide recommendations to minimize floodplain development. Investigate and pursue options for habitat protection such as conservation easements, and the Umatilla County buyout program.

Transportation Networks

1.2.5 Remedy or reduce impacts of the streamside road on the South Fork Umatilla. Pursue opportunities to either remove the streamside road on the South Fork Umatilla River, from Thomas Creek down to the North Fork Umatilla confluence or, if removal is infeasible, reduce habitat impacts resulting from the presence and use of this road, and restore channel complexity.

1.2.6 Work with Union Pacific Railroad to improve floodplain connectivity, habitat complexity and water quality. The railroad line that runs along the Umatilla River and Meacham Creek restricts natural hydrologic function, prevents growth of streamside vegetation, and contributes to the loss of instream complexity, sinuosity and seasonal floodplain discharge. Develop strategies where feasible and appropriate to ameliorate the impacts of the railroad grade on bull trout.

1.2.7 Address adverse effects resulting from the county road along the Umatilla River from Meacham Creek to the North and South Forks. Problems include bank stabilization, plugged culverts, and sedimentation from unpaved sections at the upper end.

1.3. Water Quality

1.3.1 Pursue opportunities for shade tree development behind flood control dikes (*i.e.*, outside of the channel). Large trees can contribute shade to the stream channel from behind dikes. Work with urban and semi-rural landowners to restore riparian cover behind dikes.

1.3.2 Continue to implement the Umatilla River Basin TMDL and Water Quality Management Plan, prioritizing actions related to stream temperature, the adverse effects of the County road along the Umatilla River from Meacham Creek to the NF Umatilla River, addressing storm runoff problems in urban areas, and other water quality problems associated with private residences along the Umatilla River.

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

Fish Passage Issues

2.1.1 Identify and correct the remaining unscreened diversions and pumps that may affect bull trout from the North Fork Umatilla down to the Columbia River. Utilize the results of inventories conducted by the Confederated Tribes of the Umatilla Indian Reservation and others.

2.1.2 Remedy passage issues at Feed Canal/Cold Springs Diversion Dam on the Umatilla River. Passage was provided at the dam but since has developed difficulties.

2.1.3 Assess and rectify upstream passage at all diversion dams on the mainstem, including Browns Dairy. Ensure passage facilities meet criteria for all life stages of bull trout including juveniles.

2.1.4 Complete ongoing culvert and other transportation related assessments and implement solutions where barriers affect bull trout.

Temperature Barriers

2.1.5 Implement stream restoration measures to remedy temperature barriers, particularly in the lower end of SF Umatilla River where a temperature barrier during the warmer times of the year may be preventing bull trout from accessing cold water tributaries upstream.

2.2. Fisheries Management

2.3. Small Population Size

Genetic & Demographic Stochasticity

2.3.1 Develop a genetic management plan. As the first step in initiating supplementation develop a genetic management plan for the Umatilla

Core Area that includes recommended actions for population augmentation and re-introductions (within historical distribution).

2.4. Forage Fish Availability

3. Actions to Address Nonnative Fishes

None

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

Research

4.2.1 Investigate bull trout movement between other Lower Mid-Columbia core areas and ensure opportunities for connectivity. Investigate the potential for movement between core areas via lower sections of the Walla Walla, Touchet, and Umatilla Rivers and the Columbia River.

Monitoring

4.2.2 Develop a long term monitoring program to assess status and trend of bull trout in the Umatilla Core Area. Collaborate with partners to develop a rigorous and cost effective monitoring plan capable of detecting change in demographic metrics and effectiveness of recovery efforts. Conduct regular surveys in potential habitat where bull trout status is unknown or recolonization is anticipated. Coordinate with efforts to develop a region-wide monitoring plan. Continue to coordinate surveys among partner agencies.

4.2.3 Continue maintenance and operation of fish screens on all diversions. To prevent entrainment, consistent monitoring and maintenance is necessary to keep fish screens operating properly.

4.3 Nonnatives

Research

4.3.1 Determine distribution of brook trout in Meacham Creek and eradicate or control as feasible.

Conservation Recommendations

- Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist. While working groups may be facilitated by any interested stakeholder, most often they are organized and facilitated by the Service, a State agency, U.S. Forest Service, or a Tribal entity. Although the Service has no guidelines for format or process, existing working groups are largely informal, are organized at various scales (*e.g.*, core area, river basin, geographic region, or recovery unit) and generally meet at least annually.

- Maintain bull trout protection as high priority for Oregon's Cooperative Enforcement Program to enforce angling regulations and minimize illegal harvest of bull trout. This includes conducting additional patrols during vulnerable times (*e.g.*, spawning), and coordination between enforcement agencies.

- Provide information to the public about bull trout identification, special regulations, and habitat needs (including bi-lingual signing). Develop interpretive signs for day use areas, posters, newspaper articles on bull trout identification, life history, and fishing regulations. Develop educational material in English and Spanish languages. Target key spawning/rearing and resident adult areas for education. Pursue cooperation on education projects with other governmental agencies, County parks, angler and other recreational organizations, and local newspapers.

- Evaluate and implement actions to encourage beaver recolonization. To assist in re-establishing functional riparian communities, Federal, Tribal and State resource managers should identify and implement measures to increase beaver abundance where feasible and biologically supportable. Reduction in beaver trapping pressure, increases in active releases, and utilization of beaver control structures should be considered where effective and appropriate.

Walla Walla River Core Area

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

Urban Development and Agricultural Practices

1.1.1 Protect and, where needed, revegetate riparian zones in areas used by bull trout. Consider incentives to encourage landowners and land management agencies to improve riparian conditions.

1.1.2 Implement measures identified in the Snake River Salmon Recovery Plan. Complete actions identified to improve riparian vegetation, floodplain connectivity, channel complexity and other limiting factors identified in the salmon recovery plan within bull trout FMO and SR habitat.

1.2. Instream Impacts

Flood Control

1.2.1 Protect floodplain and riparian function. Take steps to provide long-term habitat protection of important bull trout habitat through a variety of means including land purchases from willing sellers, conservation easements riparian and floodway easements, land exchanges, and initiate conservation acquisitions. Pursue opportunities to protect spawning and rearing habitat, riparian buffers, and instream flows on private lands.

1.2.2 Restore riparian and floodplain function including channel structure and complexity in areas used by bull trout through the implementation of dike setback, floodplain reconnection, channel reconstruction, and off channel habitat projects. Remove historical levees to improve interaction with floodplain, habitat complexity and water quality. Consider incentives to encourage landowners and land management agencies to improve riparian, floodplain and channel condition.

1.2.3 Pursue opportunities for shade tree development behind flood control dikes (*i.e.*, outside of the channel). Large trees can contribute shade to the stream channel from behind dikes. Work with urban and semi-rural landowners to restore riparian cover behind dikes.

1.2.4 Evaluate and improve the methods used to repair damage resulting from floods. Floods continue to occur and may cause levee damage and downcutting in Walla Walla River and lower Mill Creek. Work with relevant agencies and landowners to use flood repair activities that do not adversely harm bull trout or their habitat.

1.2.5 Protect flood prone areas from development. Work with City and County agencies to reduce or eliminate development of floodplain areas for any purpose except to dissipate flood water and energy or to perform restoration activities. Where possible, restore floodplain connectivity, remove or set-back levees, and increase off channel areas. Identify potential development concerns (*e.g.*, conversions of farms/ranches to subdivisions) to county and city land use planning entities. Provide recommendations to minimize floodplain development. For example, in lower Mill Creek, protect the south side from further development in flood prone areas.

1.2.6 Evaluate the adequacy of the City of Walla Walla and U.S. Army Corps of Engineers flood control project operations (*e.g.*, water level manipulation, entrainment, minimum flows) in Mill Creek and Walla Walla River for bull trout passage and habitat. Provide operating recommendations (FERC relicensing process and/or Federal consultation). Provide recommendations to improve bull trout passage through the entire Mill Creek flood control project.

Water Management

1.2.7 Determine appropriate instream flows in Walla Walla River and Mill Creek. In the case of Mill Creek below the City of Walla Walla intake, provide optimal minimum stream flow values for bull trout on a monthly basis to water users and flood control operators. Identify probable low-flow scenarios and prepare an operational plan to minimize impacts.

1.2.8 Pursue opportunities to increase instream flows in areas occupied by bull trout. Promote use of Conserved Water Program (OWRD), Trust Water Rights Program (WDOE), programs of the Oregon Water Trust, the Oregon Water Resources Department upriver management program for the Walla River, and irrigation district water conservation activities. Work with towns, cities, and counties to address water conservation to increase instream flows. Implement methods to protect conserved water instream.

1.2.9 Develop and implement a long-term solution to maintain adequate streamflows at and beyond Nursery Bridge. This includes protecting bypass flows for fish on both the Oregon and Washington side of the Walla Walla River, down to the Mill Creek confluence and beyond. Continue to work with irrigation districts and others toward development of long-term solution to maintaining sufficient instream flows. Implement methods to protect conserved water instream.

1.2.10 Investigate groundwater-surface water interactions and implement study recommendations. Work with water management agencies to address how groundwater withdrawal affects instream flows.

1.2.11 Explore opportunities for above ground and below ground water storage to improve stream flows. Store winter water for summer irrigation water use. Explore and evaluate shallow water recharge as a technique to improve instream flows for bull trout.

1.3. Water Quality

1.3.1 Take corrective actions or otherwise address storm runoff problems (*e.g.*, sediment inputs, waste dumping in storm drains, toxic discharges) in urban areas along the Walla Walla River and Mill Creek. This includes monitoring discharge from Milton-Freewater drain pond, and if necessary, taking action to prevent toxics from entering the Walla Walla River.

1.3.2 Improve instream habitat complexity. Restoration activities should focus on: increasing instream habitat complexity, off-channel habitat, and high flow refugia by adding large wood; managing riparian areas for a future supply of large wood, adequate shade, and diverse allochthonous inputs; and reducing fine sediment and water quality impacts from intense land use activity.

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

Entrainment

2.1.1 Continue to address screening needs on diversions and pumps as they arise and implement projects where necessary and feasible. An inventory of screening needs has been completed and since then over 800 screen projects have been implemented. Use the voluntary Washington Department of Fish and Wildlife Cooperative Compliance Review Program to identify and properly screen diversions; explore similar opportunities in Oregon.

2.1.2 At the Bennington Diversion Dam on Mill Creek, implement fish screen improvements or establish flow diversion criteria that ensure bull trout are rarely swept into Bennington Lake. Current Army Corps of Engineers' diversion criteria stipulate diversions into the lake when stream flows reach 3,500 cfs, which results in diversions approximately once every 30 years. Also evaluate installation of a trash barrier at Bennington Diversion Dam.

2.1.3 Establish connectivity between Mill Creek and the Walla Walla River through the Yellowhawk/Mill Creek channel complex and prevent entrainment and stranding. Instream flow is insufficient to support fish habitat in these streams during the summer. Address any passage barriers. Explore and implement passage and FMO enhancement opportunities, as possible or appropriate, in Yellowhawk Creek, Titus Creek/Ditch and Jones Ditch.

2.1.4 Develop and implement a corrective action (*e.g.*, screens, passage) to address fish stranding problems in the Titus Creek/Ditch. The Mill Creek Working Group is currently working to determine the best course of action and expects to complete this in 2015.

2.1.5 Continue monitoring, maintenance and operation of fish screens on all diversions. To prevent entrainment consistent monitoring and maintenance is necessary to keep fish screens operating properly.

2.1.6 Continue bull trout salvage programs, as needed. Improve coordination for fish salvage at diversions and ditches as appropriate.

Passage Barriers

2.1.7 Ensure that the Bennington Diversion Dam fish ladder is adequate for upstream migration during all flow conditions. Incorporate a fish trap, video monitoring or other method to monitor the number of fish moving upstream through the dam. Designs are currently completed and awaiting funding.

2.1.8 Modify existing weirs and dams to ensure upstream passage on Mill Creek for all flow conditions. Upstream of the Division Diversion, 3 of the 84 weirs have been modified; designs have been completed for the remaining 81. Downstream of the Division Diversion, 4 of the 500+ have been addressed. Ensure modifications provide sufficient passage during low flow conditions.

2.1.9 Complete ongoing culvert and other transportation related assessments and implement solutions where barriers affect bull trout passage. Assessment in Washington is complete, Oregon and private lands assessment still needed.

2.1.10 Maintain and improve passage through the Milton Freewater flood control system.

2.1.11 Improve passage at the City of Walla Walla Intake upstream fish ladder. Provide attraction water at the existing ladder to improve upstream movement of bull trout. Ensure that ladder meets fish passage criteria and effectively passes bull trout during all flows.

2.2. Fisheries Management

2.3. Small Population Size

2.4. Forage Fish Availability

3. Actions to Address Nonnative Fishes

3.1. Nonnative Fishes

3.1.1 Implement management actions to reduce nonnative fishes where bull trout will benefit and where appropriate.

3.1.2 Provide information to the public about bull trout identification, special regulations, and habitat needs (including bi-lingual signing). Develop interpretive signs for day use areas, posters, newspaper articles on bull trout identification, life history, and fishing regulations. Develop educational material in English and Spanish languages. Target key spawning/rearing and resident adult areas for education effort.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.2.1 Develop a long term monitoring program to assess status and trend of bull trout in the Walla Walla River Core Area. Collaborate with partners to develop a rigorous and cost effective monitoring plan capable of detecting change in demographic metrics and effectiveness of recovery efforts. Use PIT tag infrastructure to capture movement into the Columbia River. Conduct regular surveys in potential habitat where bull trout status is unknown or recolonization is anticipated. Coordinate with efforts to develop a region-wide monitoring plan. Continue to coordinate surveys among partner agencies. Utilize existing research and monitoring developed through salmon recovery planning for developing monitoring program.

4.2.2 Evaluate incidental and illegal harvest of bull trout. Examine the extent to which incidental and illegal harvest of bull trout impacts the migratory portion of the population. If impacts are significant consider actions and measures to reduce the impact, including assigning a higher priority to the conservation recommendations.

4.3 Nonnatives

4.2.3 Assess distribution of brook trout in Big Spring Branch of the East Little Walla Walla and other Spring Branches of the Walla Walla River and evaluate the need for control. Periodically and regularly survey to determine the extent of brook trout distribution. If dispersal and colonization become apparent consider measures of control or eradication.

Conservation Recommendations

- Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist. While working groups may be facilitated by any interested stakeholder, most often they are organized and facilitated by the Service, a State agency, U.S. Forest Service, or a Tribal entity. Although the Service has no guidelines for format or process, existing working groups are largely informal, are organized at various scales (*e.g.*, core area, river basin, geographic region, or recovery unit) and generally meet at least annually.

- Evaluate alternative access across river for cabin owners in the South Fork Walla Walla River between National Forest boundary and Harris Park.

- Maintain bull trout protection as high priority for Oregon's Cooperative Enforcement Program and Washington Department of Fish and Wildlife enforcement division. This includes conducting additional patrols during vulnerable times (*e.g.*, spawning), and coordination between enforcement agencies. Target enforcement in the South Fork Walla Walla River from Harris Park upstream, in the Walla Walla River at Nursery Bridge and Cemetery Bridge and in upper Mill Creek.

- Provide information to the public about bull trout identification, special regulations, and habitat needs (including bi-lingual signing). Include impacts of recreational dam building and swimming holes. Develop interpretive signs for day use areas, posters, newspaper articles on bull trout identification, life history, and fishing regulations. Target key spawning/rearing and resident adult areas for education effort (*e.g.*, South Fork Walla Walla River at Harris Park, the Bureau of Land Management trailhead and upper Mill Creek). Pursue cooperation on education projects with other governmental agencies, the Washington State University Center for Environmental Education, County parks, angler and other recreational organizations, and local newspapers.

Touchet River Core Area

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

Urban Development and Agricultural Practices

1.1.1 Protect and, where needed, revegetate riparian zones in areas used by bull trout. Consider incentives to encourage landowners and land management agencies to improve riparian conditions.

1.1.2 Implement measures identified in the Snake River Salmon Recovery Plan. Complete actions identified to improve riparian vegetation, floodplain connectivity, channel complexity and other limiting factors identified in the salmon recovery plan within bull trout FMO and SR habitat.

1.1.3 Protect floodplain and riparian function. Take steps to provide long-term habitat protection of important bull trout habitat through a variety of means including land purchases from willing sellers, conservation easements riparian and floodway easements, land exchanges, and initiate conservation acquisitions. Pursue opportunities to protect spawning and rearing habitat, riparian buffers, and instream flows on private lands.

1.2 Instream Impacts

Flood Control

1.2.1 Pursue opportunities for shade tree development behind flood control dikes (*i.e.*, outside of the channel). Large trees can contribute shade to the stream channel from behind dikes. Work with urban and semi-rural landowners to restore riparian cover behind dikes.

1.2.2 Reduce, prevent, and minimize development in floodplains. Work with City and County agencies to reduce or eliminate development of floodplain areas for any purpose except to dissipate flood water and energy or to perform restoration activities. Where possible, restore floodplain connectivity, remove or set-back levees, and increase off channel areas. Identify potential development concerns (*e.g.*, conversions of farms/ranches to subdivisions) to county and city land use planning entities. Provide recommendations to minimize floodplain development.

1.2.3 Evaluate and improve the methods used to repair damage resulting from floods. Work with relevant agencies and landowners to use flood repair techniques that do not adversely harm bull trout or their habitat.

1.2.4 Pursue opportunities to restore floodplain function and channel complexity (*e.g.*, sinuosity) in areas utilized by bull trout. Explore the use of landowner incentives to encourage these types of actions.

1.2.5 Improve instream habitat through wood recruitment. Restore floodplain connectivity by levee removal or setbacks to allow for trees and vegetation within the floodplain. Consider incentives to encourage landowners and land management agencies to improve riparian conditions.

Transportation Networks

1.2.7 Address road issues in the upper Touchet River Basin. Specific actions include: (1) minimize use of, close, or eliminate fords on the Wolf Fork Touchet, (2) work with landowners to minimize the number of private crossings; (3) reduce Bluewood Ski Area road impacts and water quality issues (North Fork Touchet), and (4) minimize or eliminate private crossings in North Fork Touchet.

1.2.8 Evaluate alternative access across river for cabin owners in the upper South Fork Touchet River.

1.3 Water Quality

Agricultural Practices

1.3.1 Develop and implement comprehensive livestock grazing management plans. Develop, implement, and revise, when necessary, adaptive livestock grazing management plans. Use current proven technology, (*e.g.*, fencing, changes in timing and use of riparian pastures, off-site watering and salting, etc.), to reduce grazing impacts. Work with landowners, managers, and agriculture agencies to fence around streams and riparian areas and build off-site watering facilities. Include mid-season performance standards that maintain stream channel conditions for quality bull trout spawning and rearing habitat.

1.3.2 Take corrective actions or otherwise address storm runoff problems (*e.g.*, sediment inputs, waste dumping in storm drains, toxic discharges) in urban areas along the Touchet River.

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.1.1 Improve passage at Dayton Steelhead Acclimation Pond Dam for bull trout. Bull trout passage is impeded during steelhead trapping which delays their migration into the upper Touchet forks.

2.1.2 Monitor and repair screens throughout basin. List priorities for action and implement screen projects. Use the voluntary Washington Department of Fish and Wildlife Cooperative Compliance Review Program to identify and properly screen diversions.

2.1.3 Assess and remove permanent and seasonal barriers to bull trout migration. Identify complete, partial, or seasonal barriers caused by debris jams, rock barriers, irrigation wing dams, culvert drops, bridge crossings, or other manmade structures that hinder or prevent bull trout from accessing upstream spawning or rearing habitat.

2.2. Fisheries Management

2.3. Small Population Size

2.4. Forage Fish Availability

3. Actions to Address Nonnative Fishes

3.1. Nonnative Fishes

3.1.1 Design and implement an educational effort about the problems and consequences of unauthorized fish introductions.

3.1.2 Implement management actions to reduce nonnative fishes where bull trout will benefit and where appropriate.

3.1.3 Provide information to the public about bull trout identification, special regulations, and habitat needs (including bi-lingual signing). Develop interpretive signs for day use areas, posters, newspaper articles on bull trout identification, life history, and fishing regulations. Develop educational material in English and Spanish languages. Target key spawning/rearing and resident adult areas for education effort (*e.g.*, the upper Touchet drainage). Pursue cooperation on education projects with other governmental agencies, the Washington State University Center for Environmental Education, County parks, angler and other recreational organizations, and local newspapers.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.2.1 Further define bull trout distribution and habitat use in the core area. Investigate bull trout movement between local populations and the Walla Walla Core Area. Additional research and information is needed to determine use, habitat suitability, and abundance of bull trout in the South Fork. Work with property owners to survey and monitor the South Fork population. Utilize existing research and monitoring developed through salmon recovery planning for developing monitoring program.

4.2.2 Continue ongoing population monitoring efforts within the basin. Maintain current long term datasets assessing abundance and distribution of bull trout. Continue to coordinate surveys among partner agencies.

4.2.3 Continue maintenance and operation of fish screens on all diversions. To prevent entrainment consistent monitoring and maintenance is necessary to keep fish screens operating properly.

4.3 Non-natives

Upper Mid-Columbia Geographic Region

Salmo River Core Area

1. Actions to Address Habitat Threats

1.1.1 Complete Watershed Action Plan. Work with transboundary stakeholders to complete the Salmo River Watershed Aquatic Ecosystem Health Action Plan. Identify areas for improving pool frequency, habitat complexity, thermal refugia, and riparian vegetation conditions.

1.1.2 Improve riparian and instream habitat. Identify areas within local populations which need habitat restoration. Implement projects to improve instream habitat by restoring recruitment of large woody debris and pool development. Revegetate streambanks to restore shade and canopy, riparian cover and native vegetation.

2. Actions to Address Demographic Threats

2.1.1 Assess and remove barriers. Assess and remove barriers throughout watershed from beaver dams, intakes, and subsurface flows. Work with transboundary partners to identify and prioritize barriers for removal or correction; focusing on tributary mouths and spawning/rearing areas.

2.2.1 Increase enforcement of fishing regulations (Canada). Work with Canada to increase enforcement of illegal harvest of bull trout in the mainstem and tributaries. Work with transboundary partners to develop outreach and education throughout the watershed to reduce illegal harvest.

3. Actions to Address Nonnative Fishes

3.1 Nonnative Fishes

3.1.1 Suppress non-native populations. Suppress brook trout populations throughout the core area focusing on spawning/rearing tributaries. Work with transboundary partners to prevent invasion of brook trout into unoccupied areas such as the South Fork.

3.1.2 Seattle City Light and partners will reduce entrainment of non-native predatory species such as pike, bass, and walleye at Boundary Dam.

4. Research, Monitoring, and Evaluation

4.1.1 Monitor and assess South Fork population. Conduct routine surveys and population assessments for the US portion of the South Fork to determine status, use of tributaries, identify spawning and rearing areas, and identify passage barriers.

4.1.2 Research extent of the use of the Pend Oreille River FMO. Determine the use of the mainstem Pend Oreille River by Salmo River bull trout, including distribution, timing, and extent of movement patterns, including use of other tributaries to the Pend Oreille downstream of Boundary Dam. Work with Canadian partners to track bull trout movements downstream of Boundary Dam.

Methow River Core Area

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

Agriculture Practices

1.1.1 Maintain, restore, and protect riparian areas. Work with landowners, conservation districts, State, etc. to develop good management practices for riparian areas adjacent to spawning, rearing and forage/migration/overwintering habitats (*i.e.*, Lower Gold, Twisp, Wolf, Early Winters, Lost, Chewuch spawning and rearing and Methow, Beaver, and Columbia FMO areas).

Forest Management Practices

1.1.2 Maintain, restore, and protect riparian zones and stream channels in all local populations. Along with ongoing implementation of the NW Forest Plan, implement the Okanogan-Wenatchee Forest Restoration Strategy, to protect and improve riparian reserves and stream channels as part of planning. Develop new Okanogan-Wenatchee National Forest Management Plan to incorporate at least these strategies and goals to insure protection of floodplains, riparian areas, and stream channels to maintain and restore bull trout habitat. Include FMO habitat and upland stream channel that drain to bull trout spawning and rearing habitat.

Livestock Grazing

1.1.3 Reduce grazing impacts. Fencing, changes in timing, and the use of riparian pastures, off site watering and salting, and other measures can be used to minimize grazing impacts. Evaluate ongoing allotment management for effects to bull trout and bull trout critical habitat. Modify management as needed, to reduce or eliminate effects that would retard recovery of bull trout populations and/or bull trout designated critical habitat. Conduct implementation and effectiveness monitoring, using accepted interagency monitoring protocols currently. Apply monitoring results to modify allotment management as necessary. Work with allotment plans in Gold, Beaver, Twisp, Wolf, Goat, Early Winters, and Chewuch above and below the forest boundary to reduce grazing impacts.

Residential Development and Urbanization

1.1.4 Reduce impacts to riparian areas and stream banks from residential development and urbanization. Residential developments cause reduced floodplain functions from runoff patterns, flood protection structures, and riparian area degradation. Work with cities, counties, COE to develop shoreline protection rules that minimize impacts to bull trout areas in lower portions of spawning and rearing streams and FMO habitat.

Transportation Networks (e.g., major highways, railroads, etc.)

1.1.5 Reduce habitat and floodplain impacts. Both spawning and rearing and FMO habitat are impacted by legacy and current Federal, State, and county highways and railroads (*i.e.*, Beaver, Twisp, lower Goat, Early Winters spawning and rearing areas and lower Gold, lower Chewuch, Methow and Columbia FMO, etc.). Location and management of roads constrict floodplains, create flooding issues, reduce habitat complexity and cause altered water quality and flow patterns.

Recreation

1.1.6 Reduce impacts from recreation to riparian areas and instream habitat. Riparian and floodplain impacts exist in large managed and dispersed camping areas in most local populations and some FMO habitats (Twisp, Early Winters, Wolf Lost, Chewuch, Lake and Upper Methow spawning and rearing; Black, Cougar, and Hidden Lakes, Methow, and Chewuch FMO; and Columbia River). Rock dams, camping, rafting, boating, horse camps, etc. continue to impact areas along spawning and rearing habitats. Continue to fund Respect the River, post signs, and use enforcement to mitigate impacts. Determine impacts from riparian camping areas directly adjacent to spawning areas (Twisp, Early Winters, and Lost R) and improve, move, or continue with restoration and adaptive management. Potentially relocate high risk areas or close with timing restrictions areas with direct impacts.

1.2 Instream Impacts

Agricultural Practices

1.2.1 Protect and Improve riparian areas and floodplains. Work with local State, Federal, county, NRCS, and conservation district partners to improve habitat complexity, riparian areas, and floodplains. Improve water quality at agriculture return and reduce/eliminate interbasin transfer.

Forest Management Practices

1.2.2 Implement stream restoration projects in degraded stream reaches. Legacy forest practices have impacted most bull trout habitat and upstream tributaries. Identify and prioritize opportunities for stream restoration. Design and implement projects focusing on whole watershed restoration. National Forest lands and private lands containing bull trout habitat need to be assessed. Link to ongoing restoration activities with other planning processes as they relate to salmon and steelhead already in progress so as not to duplicate efforts. Restoration activities should focus on: increasing instream habitat complexity, off-channel habitat, and high flow refugia by adding large wood; managing riparian areas for a future supply of large wood, adequate shade,; and repairing culverts, drainage, connectivity for passage and reducing fine sediment and water quality impacts from roads and other land use activities.

Dewatering (natural)

1.2.3 Reduce impacts from management to populations that have natural dewatering of spawning and rearing areas. Dewatering during times of low flow, impact amounts of available spawning habitat. Focus on minimizing impacts and protect watersheds in several populations (*i.e.*, Twisp, Lost, Upper Methow, and Beaver) that are vulnerable. Research is needed to understand if natural due to long term impacts from legacy threats.

Entrainment

1.2.4 Develop adequate passage to connect FMO to spawning and rearing habitat while minimizing impacts to both bull trout and prey species. Entrainment occurs at the Columbia River hydropower dams (*i.e.*, Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids Dams). As well, there is entrainment in local populations (*i.e.*, Lower Gold, Beaver, Twisp, Wolf, Goat, Early Winters, Chewuch, and at some mainstem Methow diversion dams). Continued focus should be on reducing entrainment, maintaining/improving upstream and downstream bull trout passage, and reducing habitat impacts. Research and ongoing monitoring is needed to determine and fix the screen/structures that are degraded, not functioning appropriately, or not in compliance.

Connectivity/Fish Passage

1.2.5 Connect FMO and Spawning and Rearing habitat. Columbia River hydropower dams, Lower Gold, Beaver Twisp, Wolf, Goat, Early Winters, Chewuch, and mainstem diversion dams, Twisp weir; continue to block and impede passage. Rock dam building within some populations at campgrounds or developed areas also impede juvenile or sub-adults. Develop adequate passage to connect FMO and spawning and rearing habitat and maintaining critical habitat PCEs. Prioritize connecting FMO to spawning and rearing habitat. Minimize ongoing impacts from Hydropower dams and Twisp Weir through adaptive management of Wells Dam FERC relicensing.

Residential Development and Urbanization

1.2.6 Reduce impacts from development. Current and future impacts include encroachment on floodplain and riparian habitat, impervious surface with poor runoff patterns, stormwater treatment, and water use. Spawning and rearing areas with areas of impact include: lower Gold, Beaver, Twisp, Wolf, Goat, and Early Winters, lower Lost, lower Chewuch and upper Methow; FMO impacts occur along the Methow and Columbia Rivers. Riprap, dikes, roads, impervious surfaces impact channel and water flows and water quality, and increased boat docks and use occurs near the mouth of the Methow in the Columbia River.

Transportation Networks (e.g., major highways, railroads, etc.)

1.2.7 Reduce impacts to adjacent instream habitat, and remove passage barriers. Major Federal/State highways impact the Methow and Columbia FMO; and spawning and rearing areas in Gold, Twisp, Goat, Early Winters, upper Methow, and Beaver; and other County roads will have ongoing impacts. Develop long term solutions to provide for functioning floodplains, improve water runoff, and reduce potential for long term impacts from spraying of chemicals and de-icer.

Altered Flows

1.2.8 Secure appropriate instream flows and move towards more natural flow regimes. Improving instream flows will help restore connectivity, decrease water temperatures and create higher quality habitat providing bull trout with more opportunities for migration and habitat for rearing. Methow, Columbia FMO and some spawning and rearing in Gold, Beaver, Twisp, Wolf, Goat, Early Winters, Lost R, and Chewuch are degraded. Improve dams/diversions to leave more water in the channel by improving flow management, improving conveyance ditches, and headgate/diversion features. Mouth is influenced by Columbia River elevations which may impede connectivity from operations of large hydropower projects.

Maintain and improve special use permits and implement flow management of all species.

Water Quality Impairment

1.2.9 Meet instream water quality standards. Improve water quality in the303d listed reaches (*i.e.*, Methow, Chewuch, Gold, mainstem Columbia River) for temperature and dissolved oxygen. Improve water quality in diversion return flows in all areas.

Climate Change

1.2.10 Improve habitat complexity, water quality, and connectivity. FMO areas are lacking in habitat complexity, connectivity, while some lower/warmer spawning and rearing areas will need refuge and complex habitat. Focus on restoration that improves habitat complexity in lower elevation FMO areas. Also improve connectivity in all FMO and spawning and rearing areas (*i.e.*, between the Methow and Columbia FMO and spawning and rearing areas and their FMO in the Methow River).

1.3. Water Quality

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

Agriculture

2.1.1 Improve connectivity at both large and small diversion and improve water quality. See above for instream habitat connectivity/fish passage. Improve 303d listed reaches associated with agriculture. Stream temperature and Agriculture chemicals have legacy and current impacts for connectivity of bull trout habitat.

Forest Management

2.1.2 Improve and maintain forest roads to provide. Legacy and current forest management continues to impair connectivity in most habitats. Improve forest roads so that connectivity between spawning and rearing areas, and forage, migration, and overwintering habitat is accessible.

Dewatering (natural)

2.1.3 Reduce management impacts and improve access for timing of use. Natural dewatering occurs during low water years in Twisp, Lost, Beaver, and Upper Methow and can be further impacted with management and/or climate change. Insure riparian protections and instream flows are maintained to insure fish can migrate earlier if necessary. Minimize management impacts to these populations during low water years and improve connectivity downstream to insure timing for use of these streams is not restricted.

Entrainment (hydropower and diversions)

2.1.4 Reduce entrainment. Entrainment occurs at all mainstem Columbia River dams (*i.e.*, Wells, Rocky Reach, Rock Island, Wampum, and Priest Rapids Dams). As well, there is entrainment in local populations (*i.e*., Lower Gold, Beaver, Twisp, Wolf, Goat, Early Winters, Chewuch, and at mainstem Methow diversions. Continue to reduce or remove entrainment issues. Improve monitoring efforts at diversions with ongoing impacts to insure long term operation and accurate monitoring of screens/headgates.

Fish Passage

2.1.5 Improve fish passage at all dams, smaller diversions, and at road crossings. Fish passage is fully or partially blocked; causing blocked or altered movement from downstream to upstream spawning/rearing and migration areas. Continue monitoring and adaptively managing PUD ladders on Columbia mainstem and improve downstream passage, develop both improved upstream and downstream passage at diversions in Gold, Beaver, Twisp, Wolf, Goat, Early Winters, Chewuch and mainstem Methow diversions and at Twisp Weir.

Transportation Networks

2.1.6 Reduced impacts from transportation networks. Improve management practices for maintenance and construction of roads. Transportation Networks impede passage and indirectly impairs connectivity habitat. Culverts, road locations, sediments, and chemical use directly impair connectivity corridors for most local populations.

Altered Flows

2.1.7 Improve stream flows to a more normative pattern so connectivity and refuge habitat are improved. Altered flows from diversions change flow patterns from normal patterns. See Entrainment and Fish Passage above. Focus on reduce changes that historically altered or currently alter migration timing and use.

Climate Change

2.1.8 Maintain/improve cool water refuge, water quality, and flows for movement. Climate change will alter stream flows, and increase temperatures impacting passage. Climate change is predicted to influence rain/snow patterns, stream flow patterns, and stream temperatures and cause reduced or limited use of migratory corridors in FMO habitats and spawning/rearing areas. The Methow is predicted to maintain some of the best refuge habitat due to remaining glaciers. Temperature barriers already exist in sections of the Methow and Columbia R. FMO and are expected to further degrade areas of spawning and rearing habitat.

2.2. Fisheries Management

Angling/Harvest

2.2.1 Reduce incidental catch and poaching. Incidental catch associated with open fisheries and poaching in closed areas impact populations in the Methow Basin. Continue to develop fishing regulations and harvest rules to protect bull trout. Recreationists continue to misidentify bull trout. Continue to post signs/educate in camp grounds. Need research to understand impacts of incidental catch in other catch/keep fisheries for trout and salmon particularly in spawning and important adult FMO areas (*i.e.*, Methow mainstem, Black Lake, and Lost River fisheries). The Lost River is the only open area to bull trout fishing in Eastern Washington. Illegal poaching is occurring in several basins (*i.e*., Lower Lost River, Early Winters below the highway, Lake Creek/Black Lake fishery, and in the upper Lost River and associated lakes). Develop enforcement plans to target incident areas.

Introduced Species

2.2.2 Continue to consider stocking of native species and reduction of brook trout a priority. Continue to provide good management and effective stocking plans that improve the native fish assemblages. Reduce non-natives in areas of overlap with bull trout (*i.e.*, Gold, Beaver, Twisp, and Chewuch). In areas of FMO in the Columbia River, research impacts from introduced non-native rainbow, and brown trout and other species (*i.e.*, bass and walleye) in the Columbia River. Watch for brown trout and northern pike in from the Columbia River. Continue to develop feasibility assessment for a brook trout removal plan.

Fisheries Management

2.2.3 Reduce impacts from incidental catch during other fisheries monitoring activities. Use timing and equipment that reduce impacts. Increased fish management and need for monitoring associated with impacts caused by Federal Columbia River Power System causes increased handling and catch of bull trout. Winthrop/Methow/ and Columbia River hatchery released fish can interact and residualize. Identify and adjust management where species interactions may be an issue for populations of bull trout with low abundances.

2.3. Small Population Size

Genetic/Demographic Stochasticity

2.3.1. Improve genetic and demographic stochasticity. Improving passage and connectivity for populations to interact as a metapopulation will improve stochasticity. Insure resilience and redundancy. Half of the populations (Gold, Beaver, Wolf, Goat, Early Winters, Chewuch, and Lake) in the basin are small and unstable or stable at very low numbers. Legacy impacts caused disconnected habitat for migratory forms in many of these populations. Impacts of Lost River fishery is unknown but suspected and may impact multiple life history forms.

Loss/Altered Migratory Life History

2.3.2 Improve migratory life history connectivity. Life histories have been altered (*i.e.*, fluvial to adfluvial, or fluvial/adfluvial to resident) due to legacy impediment of fish passage at hydropower dams, irrigation diversions, and splash dams from forest practices. Populations above and below dams were disconnected from spawning areas for generations in the past. Unknown risk to stochasticity however populations are small and in some cases remain as resident forms.

Fisheries Management

2.3.3 Reduce potential for negative species interactions in populations with low abundances. Species interactions from hatchery fish may be most impacting on populations with low numbers or in strongholds. Impacts from large native predators may on the rise and is considered to be a watch out situations in the FMO habitat is the Methow and Columbia Rivers (*i.e.*, lake/brown trout or northern pike). Research is needed to understand food webs in rivers and lakes.

2.4. Forage Fish Availability

Connectivity/Fish Passage

2.4.1 Improve forage fish opportunities. Hydropower and Irrigation dams and diversions, and other culverts block passage for potential native prey species. Manage passage for native fish assemblages with attention to impacts on small bull trout populations so impacts don’t further reduce numbers.

Introduced Species

2.4.2 Reduce numbers of introduced species. Brook trout out compete for habitat and food, and hybridize with bull trout (Gold, Beaver, Twisp, and Chewuch). Hybridization has been determined in several local populations. Competition for space and food occur when there is overlap with non-native species.

Fisheries Management

2.4.3 Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages. Hatchery releases may both impact (prey on and outcompete juvenile/subadult bull trout) and benefit (provide prey for adult bull trout) bull trout especially where low numbers of bull trout exist. Design species interaction studies to gather information and reduce bull trout impacts in Spawning and Rearing areas and areas used by sub-adults. Direct impacts occur as a result of operation of traps, weirs, from use of nets, and electro-shocking. Timing and methods of sampling should be considered to reduce impacts to bull trout.

3. Nonnative Fishes

3.1. Nonnatives

Introduced Species

3.1.1 Reduce numbers of introduced/non-native species. Non-native salmonids, and Brook trout out compete bull trout for habitat and food, and brook trout hybridize with bull trout. Hybridization has been determined in several local populations but distribution in unclear. Competition for space and food occur when there is overlap with non-native species (*i.e.*, Gold, Beaver, Twisp, Chewuch, Methow, and Columbia).

Fisheries Management

3.1.2 Conduct fisheries management to reduce impact on bull trout. Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages. Hatchery releases may both impact (*i.e.*, predation, competition) and benefit (*i.e.*, provide preybase) bull trout (especially where low numbers of bull trout exist. Direct impacts occur as a result of operation of traps, weirs, from use of nets, and electro-shocking. Timing and methods of sampling can reduce impacts.

Climate Change

3.1.3 Plan for and reduce potential for increased non-native competitors. Prioritize non-native removal and habitat improvement where climate change will have the most impacts to cause increased abundances of non-native species (*i.e.*, brook trout, and spiny rays and future northern pike in Columbia River).

4. Research, Monitoring, and Evaluation

4.1. Habitat

4.1.1 Develop action plan to evaluate habitat condition and determine bull trout potential for use. Use the Upper Columbia Bull Trout Technical Workgroup to develop the action plan. Evaluate and conduct habitat surveys to determine current potential for use in other areas that fall out in the patch analysis. Include the development of patch analysis. Use analysis to assist developing baseline conditions in current and future habitats and to assist with brook trout removal risk analysis.

4.1.2 Continue to monitor key bull trout habitat with temperature probes for current conditions and effects of climate changes. Develop additional locations and maintain database for NorWeST temperature database.

4.1.3 Evaluate irrigation diversion screens. Prioritize and determine options for fixing screens that are degraded, not functioning appropriately, or not in compliance.

4.1.4 Evaluate natural dewatering areas. Determine if dewatering in Twisp, Lost, Upper Methow, etc. is natural or caused by management of flows or other ongoing threats.

4.1.5 Develop brook trout eradication and monitoring plan. Work to develop prioritized plan to eradicate and monitor effectiveness of removal techniques.

4.2. Demographic

4.2.1 Develop action plan to inform and assess current status of resident and migratory bull trout. Use the Upper Columbia Bull Trout Technical Workgroup to develop the action plan. Continue to monitor trends in redd abundances. Develop a long term plan to determine changes in index areas, re-evaluate index areas, develop an estimate of total habitat surveyed, and an expansion factor for core area, etc.

4.2.2 Develop a long term monitoring program to assess distribution, status and trend of bull trout. Collaborate with partners to develop a rigorous and cost effective monitoring plan capable of detecting change in demographic metrics and effectiveness of recovery efforts. Include all life history stages to be able to develop population model. Coordinate with efforts to develop a region-wide monitoring plan.

4.2.3 Determine impacts of incidental catch in other catch/keep fisheries. Misidentification occurs in many areas and law enforcement has found bull trout are misidentified and kept. Monitor impacts from current fisheries to continue to improve upon regulations.

4.2.4 Determine level of poaching. Illegal poaching is occurring in several basins (*i.e.*, Lost R, Early Winters). It is unknown how many may be taken.

4.2.5 Develop food web analysis and predator/prey relationship in lakes, rivers, and streams to identify preybase gaps or predator threats.

4.3. Non-natives

4.3.1 Determine distribution of brook trout. Brook trout distribution is not well defined. Determine the distribution of overlap with brook trout, lake trout, brown trout and other predatory species. Where sympatry is found to occur on the spawning grounds, evaluate rates of hybridization.

Conservation Recommendations

- Continue to support existing Upper Columbia Bull Trout Technical Work Group. Continue collaboration and coordination with partnership of Upper Columbia Fish and Wildlife Recovery Board, WDFW and the U.S. Fish and Wildlife Service (Service). Although the Service has no guidelines for format or process, the existing working group is largely informal, organized at the core area scale, and meets at least annually.

- Work to develop a bull trout recovery task funding mechanism.

- Develop whole watershed restoration planning. Connect the spawning and rearing habitat to the FMO (*i.e.*, National Forest streams and reaches to the lower mainstem/State/County/private lands) for increasing connectivity of complex habitat, reducing costs, reducing redundancy, and insuring goals for all species are met.

- Insure coordination with Columbia River Federal Power System and PUD FERC projects. Develop projects in a coordinated manor to reduce redundancy, reduce impacts to bull trout, for efficiency in spending funds. Mitigation for FCRPS such as habitat improvement projects has impacts to bull trout. Additional projects could be developed specifically for bull trout in coordination with other funding efforts. Explore opportunity for development of bull trout mitigation funding mechanism that would provide cost share opportunities and insure funding of projects upstream of salmon habitat.

Entiat Core Area

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

Agriculture Practices

1.1.1 Maintain, restore, and protect riparian areas. Work with landowners, conservation districts, State, etc. to develop good management practices for riparian areas adjacent to spawning, rearing and forage/ migration/overwintering habitats (*i.e.*, Entiat Spawning and Rearing, FMO, and Columbia River FMO).

Forest Management Practices

1.1.2 Maintain, restore, and protect riparian zones and stream channels in all local populations. Along with ongoing implementation of the NW Forest Plan, implement the Okanogan-Wenatchee Forest Restoration Strategy, to protect and improve riparian reserves and stream channels as part of planning. Develop new Okanogan-Wenatchee National Forest Management Plan to incorporate at least these strategies and goals to insure protection of floodplains, riparian areas, and stream channels to maintain and restore bull trout habitat. Include FMO habitat and upland stream channel that drain to bull trout spawning and rearing habitat.

Livestock Grazing

1.1.3 Reduce grazing impacts. Fencing, changes in timing, and the use of riparian pastures, off site watering and salting, and other measures can be used to minimize grazing impacts. Evaluate ongoing allotment management for effects to bull trout and bull trout critical habitat. Modify management as needed, to reduce or eliminate effects that would retard recovery of bull trout populations and/or bull trout designated critical habitat. Conduct implementation and effectiveness monitoring, using accepted interagency monitoring protocols currently. Apply monitoring results to modify allotment management as necessary. Work with allotment plans in the Entiat, Mad Rivers above and below the forest boundary and other tributaries like Stormy and Tillicum Creeks to reduce grazing impacts.

Residential Development and Urbanization

1.1.4 Reduce impacts to riparian and stream banks from residential development and urbanization. Residential developments cause reduced floodplain functions from runoff patterns, flood protection structures, and riparian area degradation. Work with cities, counties, and COE to develop shoreline protection rules that minimize impacts to bull trout (*i.e.*, Mouth of Mad River, Entiat, and mouth of Entiat).

Transportation Networks (e.g., major highways, railroads, etc.)

1.1.5 Reduce habitat and floodplain impacts. Both spawning and rearing and FMO habitat are impacted by legacy and current Federal, State, and county highways (*i.e.*, Entiat River, mouth of Entiat, and Columbia River). Location and management of roads constrict floodplains, create flooding issues, reduce habitat complexity and cause altered water quality and flow patterns.

Recreation

1.1.6 Reduce impacts from recreation to riparian areas and instream habitat. Riparian and floodplain impacts exist in large managed and dispersed camping areas in both local populations and in FMO near the mouth associated with sandbar, and the city park with new boat launch. Implement "respect the river" education and enforcement of boat regulations.

1.2 Instream Impacts

Agricultural Practices

1.2.1 Protect and Improve riparian areas and floodplains. Work with local State, Federal, county, NRCS, and conservation district partners to improve habitat complexity, riparian areas, and floodplains (Entiat, Columbia River FMO areas, etc.).

Forest Management Practices

1.2.2 Implement stream restoration projects in degraded stream reaches. Legacy forest practices have impacted most bull trout habitat and upstream tributaries. Identify and prioritize opportunities for stream restoration. Design and implement projects focusing on whole watershed restoration. National Forest lands and private lands containing bull trout habitat need to be assessed. Link to ongoing restoration activities with other planning processes as they relate to salmon and steelhead already in progress so as not to duplicate efforts. Restoration activities should focus on: increasing instream habitat complexity, off-channel habitat, and high flow refugia by adding large wood; managing riparian areas for a future supply of large wood, adequate shade; and repairing culverts, drainage, connectivity for passage and reducing fine sediment and water quality impacts from roads and other land use activities.

Entrainment

1.2.3 Develop adequate passage to connect FMO to spawning and rearing habitat while minimizing impacts to both bull trout and prey species. Entrainment occurs at the Columbia River hydropower dams (*i.e.*, Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids Dams.

Approximately 95 percent of the two local populations use the Columbia River outside of spawning time periods. Continued focus should be on maintaining/ improving upstream and downstream bull trout passage reducing entrainment, and reducing habitat impacts. Research and ongoing monitoring is needed to determine and fix the screen/structures that are degraded, not functioning appropriately, or not in compliance.

Connectivity/Fish Passage

1.2.4 Connect FMO and Spawning and Rearing habitat. Columbia River hydropower dams and road culverts continue to impede passage. Rock dam building within some populations is on the rise at campgrounds and can impede juvenile or sub-adults. Develop adequate passage to connect FMO and spawning and rearing habitat and maintaining critical habitat PCEs. Prioritize connecting FMO to spawning and rearing habitat (*i.e.*, Columbia dams,) focusing on all life history stages with a priority to sub-adult issues.

Residential Development and Urbanization

1.2.5 Reduce impacts from development. Current and future impacts include encroachment on floodplain and riparian habitat, impervious surface with poor runoff patterns, storm water treatment, and water use. Areas along the Entiat FMO, mouth of the Mad, and the Columbia River where there are increased levels of boat docks at residences and city access points.

Transportation Networks (e.g., major highways, railroads, etc.)

1.2.6 Reduce impacts to adjacent instream habitat, and remove passage barriers. Major Federal/State highways impact the mouth of the Entiat and other county roads impact instream habitat along the Entiat River and will have ongoing impacts to floodplains, water quality, and flow patterns.

Altered Flows

1.2.7 Secure appropriate instream flows and move towards more natural flow regimes. Improving instream flows will help restore connectivity, decrease water temperatures and create higher quality habitat providing bull trout with more opportunities for migration and habitat for rearing. Off channel diversions (*i.e.*, Stormy Creek) add to reduced flows. Continue to increase efficiency of diversions to leave more water in the channel by improving flow management, improving conveyance ditches, and headgate/diversion features. Mouth of Entiat is influenced by Columbia River elevations and may impede passage as a result of management of large hydropower projects.

Water Quality Impairment

1.2.8 Meet instream water quality standards. Improve water quality the Entiat Basin and Columbia River especially in 303d listed reaches for stream temperature, DO, etc.

Climate Change

1.2.9 Improve habitat complexity, water quality, and connectivity. FMO areas are lacking in habitat complexity, connectivity, while some lower/warmer spawning and rearing areas will need refuge and complex habitat. Focus on restoration that improves connectivity in all FMO and spawning and rearing areas (*i.e.*, between Entiat and Columbia FMO and other Core and FMO areas).

1.3. Water Quality

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

Agriculture

2.1.1 Improve connectivity at both large and small diversion and improve water quality. See above for instream habitat connectivity/fish passage. Improve 303d listed reaches associated with agriculture. Stream temperature and agricultural chemicals have legacy and current impacts for connectivity of bull trout habitat (Entiat and Columbia River and other tributaries that drain into FMO and critical habitat.)

Forest Management

2.1.2 Improve and maintain forest roads to provide. Legacy and current forest management continues to impair connectivity in most habitats. There is a very high road density in the Entiat. Improve forest roads so that connectivity between spawning and rearing areas, and forage, migration, and overwintering habitat is improved and accessible.

Entrainment (hydropower and diversions)

2.1.3 Reduce entrainment. Entrainment occurs at all mainstem Columbia River dams, and some diversions. Correct entrainment issues. Maintain monitoring efforts at Stormy and other diversions to insure long term monitoring of new screens.

Fish Passage

2.1.4 Improve fish passage at all dams, smaller diversions, and at road crossings. Fish passage is fully or partially blocked; causing blocked or altered movement from downstream to upstream spawning/rearing and migration areas. Continue monitoring and adaptively managing PUD ladders on Columbia mainstem and improve downstream passage.

Transportation Networks

2.1.5 Reduced impacts from transportation networks. Improve management practices for maintenance and construction of roads. Transportation Networks along the Entiat River and at the mouth of the Entiat impede passage and indirectly impairs connectivity habitat. Culverts, road locations, sediments, and chemical use directly impair connectivity corridors for most local populations.

Climate Change

2.1.6 Maintain/improve cool water refuge, water quality, and flows for movement. Climate change will alter stream flows, and increase temperatures impacting passage. Climate change is predicted to influence rain/snow patterns, stream flow patterns, and stream temperatures and cause reduced or limited use of migratory corridors in FMO habitats and spawning/rearing areas. Temperature barriers already exist in sections of the Entiat and Columbia River FMO and are expected to further degrade areas of spawning and rearing habitat.

2.2. Fisheries Management

Angling/Harvest

2.2.1 Reduce incidental catch and poaching. Incidental catch associated with open fisheries and poaching in closed areas impact populations in the Entiat Basin. Continue to develop and monitor fishing regulations and harvest rules to protect bull trout. Recreationists continue to misidentify bull trout. Continue to post signs/educate in camp grounds. Need research to understand impacts of incidental catch in other catch/keep fisheries in Entiat and Columbia FMO areas. Illegal poaching is occurring in several basins (*i.e.*, Entiat in Box Canyon, and Mad River pools). Develop enforcement plans to target incident areas.

Introduced Species

2.2.2 Continue to consider stocking of native species and reduction of brook trout a priority. Continue to provide good management and effective stocking plans that improve the native fish assemblages. Brook trout fishery exists in upper Entiat. Implement brook trout removal plan in Entiat. Watch for invasions in Columbia River. Conduct research to understand predation rates on sub-adult bull trout in Columbia River.

Fisheries Management

2.2.3 Reduce impacts from incidental catch during other fisheries monitoring activities. Use timing and equipment that reduce impacts. Increased fish management and need for monitoring associated with impacts caused by Federal Columbia River Power System causes increased handling and catch of bull trout. Identify and adjust management where species interactions may be an issue for populations of bull trout with low abundances. Northern pike minnow fishery likely encounters some bull trout, need monitoring plan to understand impacts.

2.3. Small Population Size

Genetic/Demographic Stochasticity

2.3.1. Improve genetic and demographic stochasticity. Only two local populations are known to exist. Improving passage and connectivity for populations to interact as a metapopulation and with other core areas will improve stochasticity. Both local populations are small and unstable at very low numbers. Legacy impacts in both the Entiat and Columbia Rivers caused disconnected habitat for migratory forms.

Loss/Altered Migratory Life History

2.3.2 Improve migratory life history connectivity. Life histories have been altered due to legacy impediment of fish passage. Populations above and below Columbia River dams were disconnected from spawning areas as were populations with the Mad and Entiat Rivers. Historic splash dams and forest management has impeded passage in both the Entiat and Mad Rivers.

Fisheries Management

2.3.3 Reduce potential for negative species interactions in both local populations. Species interactions from hatchery fish may be most impacting on populations with low numbers or in strongholds. Impacts from large native predators may be watch out situations in the Columbia River (*i.e.*, Northern pike minnow). Research is needed to understand food webs in rivers and lakes.

2.4. Forage Fish Availability

Connectivity/Fish Passage

2.4.1 Improve forage fish opportunities. Hydropower and Irrigation dams and diversions, and other culverts block passage for potential native prey species. Manage passage for native fish assemblages with attention to impacts on small bull trout populations so impacts don't further reduce numbers.

Introduced Species

2.4.2 Reduce numbers of introduced species. Brook trout out compete for habitat and food, and hybridize with bull trout. Competition for space and food occur when there is overlap with non-native species. Develop brook trout removal plan.

Fisheries Management

2.4.3 Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages. Hatchery releases may both impact (prey on and outcompete juvenile/subadult bull trout) and benefit (provide prey for adult bull trout) bull trout especially where low numbers of bull trout exist. Design species interaction studies to gather information and reduce bull trout impacts in Spawning and Rearing areas and areas used by sub-adults. Direct impacts occur as a result of operation of traps, weirs, from use of nets, and electro-shocking. Timing and methods of sampling should be considered to reduce impacts to bull trout.

3. Nonnative Fishes

3.1. Nonnatives

Introduced Species

3.1.1 Reduce numbers of introduced/non-native species. Non-native salmonids, Brook trout out-compete bull trout for habitat and food, and brook trout hybridize with bull trout. Hybridization has been determined other areas of overlap. Competition for space and food occur when there is overlap with non-native species (Columbia and Entiat Rivers).

Fisheries Management

3.1.2 Conduct fisheries management to reduce impact on bull trout. Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages. Hatchery releases may both impact (*i.e.*, predation, competition) and benefit (*i.e.*, provide preybase) bull trout (especially where low numbers of bull trout exist). Direct impacts occur as a result of operation of traps, weirs, from use of nets, and electro-shocking. Timing and methods of sampling can reduce impacts.

Climate Change

3.1.3 Plan for and reduce potential for increased non-native competitors. Prioritize non-native removal and habitat improvement where climate change will have the most impacts to cause increased abundances of non-native species (*i.e.*, brook trout; and future northern pike in Columbia River).

4. Research, Monitoring, and Evaluation

4.1. Habitat

4.1.1 Develop action plan to evaluate habitat condition and determine bull trout potential for use. Use the upper Columbia Bull Trout Technical Workgroup to develop the action plan. Evaluate and conduct habitat surveys to determine current potential for use in other areas that fall out in the patch analysis. Include the development of patch analysis. Use analysis to assist developing baseline conditions in current and future habitats and to assist with brook trout removal risk analysis.

4.1.2 Continue to monitor key bull trout habitat with temperature probes for current conditions and effects of climate changes. Develop additional locations and maintain database for NorWeST temperature database.

4.1.3 Evaluate irrigation diversion screens. Prioritize and determine options for fixing screens that are degraded, not functioning appropriately, or not in compliance.

4.1.4 Develop brook trout eradication and monitoring plan. Work to develop prioritized plan to eradicate and monitor effectiveness of removal techniques.

4.2. Demographic

4.2.1 Develop action plan to inform and assess current status of resident and migratory bull trout. Use the upper Columbia Bull Trout Technical Workgroup to develop the action plan. Continue to monitor trends in redd abundances. Develop a long term plan to determine changes in index areas, re-evaluate index areas, develop an estimate of total habitat surveyed, and an expansion factor for core area, etc.

4.2.2 Develop a long term monitoring program to assess distribution, status and trend of bull trout. Collaborate with partners to develop a rigorous and cost effective monitoring plan capable of detecting change in demographic metrics and effectiveness of recovery efforts. Include all life history stages to be able to develop population model. Coordinate with efforts to develop a region-wide monitoring plan.

4.2.3 Determine impacts of incidental catch in other catch/keep fisheries. Misidentification occurs in many areas and law enforcement has found bull trout are misidentified and kept.

4.2.4 Determine level of poaching. Illegal poaching is occurring in several areas. It is unknown how many may be taken.

4.2.5 Develop food web analysis and predator/prey relationship in Columbia to identify preybase gaps or predator threats.

4.3. Non-natives

4.3.1 Determine distribution of brook trout. Brook trout distribution is not well defined. Determine the distribution of overlap with brook trout, lake trout, brown trout and other predatory species. Where sympatry is found to occur on the spawning grounds, evaluate rates of hybridization.

4.3.2 Reduce trans-basin water transfers to reduce inadvertent spread on non-native fishes.

Conservation Recommendations

- Continue to support existing Upper Columbia Bull Trout Technical Work Group. Continue collaboration and coordination with partnership of Upper Columbia Fish and Wildlife Recovery Board, WDFW and the Service. Although the Service has no guidelines for format or process, the existing working group is largely informal, organized at the core area scale, and meets at least annually.

- Work to develop a bull trout recovery task funding mechanism

- Develop whole watershed restoration planning. Connect the spawning and rearing habitat to the FMO (*i.e.*, National Forest streams and reaches to the lower mainstem/State/county/private lands) for increasing connectivity of complex habitat, reducing costs, reducing redundancy, and insuring goals for all species are met.

- Insure coordination with Columbia River Federal Power System and PUD FERC projects. Develop projects in a coordinated manor to reduce redundancy, reduce impacts to bull trout, for efficiency in spending funds. Mitigation for FCRPS such as habitat improvement projects has impacts to bull trout. Additional projects could be developed specifically for bull trout in coordination with other funding efforts. Explore opportunity for development of bull trout mitigation funding mechanism that would provide cost share opportunities and insure funding of projects upstream of salmon habitat.

Wenatchee River Core Area

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

Agriculture Practices

1.1.1 <u>Maintain, restore, and protect riparian areas</u>. Work with landowners, conservation districts, State, etc. to develop good management practices for riparian areas adjacent to spawning, rearing and forage/migration/overwintering habitats (*i.e.*, Peshastin, Icicle, and White spawning and rearing and Wenatchee and Columbia FMO areas).

Forest Management Practices

1.1.2 <u>Maintain, restore, and protect riparian zones and stream channels in all local populations</u>. Along with ongoing implementation of the NW Forest Plan, implement the Okanogan-Wenatchee Forest Restoration Strategy, to protect and improve riparian reserves and stream channels as part of planning. Develop new Okanogan-Wenatchee National Forest Management Plan to incorporate at least these strategies and goals to insure protection of floodplains, riparian areas, and stream channels to maintain and restore bull trout habitat. Include FMO habitat and upland stream channel that drain to bull trout spawning and rearing habitat.

Livestock Grazing

1.1.3 <u>Reduce grazing impacts</u>. Fencing, changes in timing, and the use of riparian pastures, off site watering and salting, and other measures can be used to minimize grazing impacts. Evaluate ongoing allotment management for effects to bull trout and bull trout critical habitat. Modify management as needed, to reduce or eliminate effects that would retard recovery of bull trout populations and/or bull trout designated critical habitat Conduct implementation and effectiveness monitoring, using accepted interagency monitoring protocols currently. Apply monitoring results to modify allotment management as necessary. Work with allotment plans in Little Wenatchee, Icicle, Peshastin and Wenatchee FMO areas below above and below the forest boundary to reduce grazing impacts.

Mining

1.1.4 <u>Reduce impacts from suction dredging</u>. Suction dredging occurs in Peshastin and Chiwawa. Improve Gold and Fish Pamphlet to reduce impacts in spawning and rearing areas from large scale mining clubs and maintain enforcement. Develop HCP with WDFW or update to reduce impacts for Gold and Fish mining rules and regulations.

Residential Development and Urbanization

1.1.5 Reduce impacts to riparian areas, streambanks, stream flows, and water quality from residential development and urbanization. Residential developments cause reduced floodplain functions from runoff patterns, flood protection structures, and riparian area degradation. High development areas include: Lake Wenatchee, Wenatchee River, Icicle and Peshastin Creeks, and other tributaries (Mission and Chumstick Creeks). Work with cities, counties, COE to improve/develop shoreline protection rules that minimize impacts to bull trout areas in lower portions of spawning and rearing streams and FMO habitat.

Transportation Networks (e.g., major highways, railroads, etc.)

1.1.6 Reduce habitat and floodplain impacts. Both spawning and rearing and FMO habitat are impacted by legacy and current Federal, State, and county highways and railroads (*i.e.*, Nason, Icicle, Peshastin spawning and rearing areas and Wenatchee and Columbia FMO, etc.). Location and management of roads constrict floodplains, create flooding issues, reduce habitat complexity and cause altered water quality and flow patterns and will have ongoing impacts.

Recreation

1.1.7 Reduce impacts from recreation to riparian areas and instream habitat. Riparian and floodplain impacts exist in large managed and dispersed camping areas in most local populations and some FMO habitats (Icicle, Chiwawa, Nason/Mill, White, and Little Wenatchee spawning and rearing; and Icicle, Peshastin, and Wenatchee, and Columbia FMO). Rock dams, camping, rafting, boating, horse camps, etc. are included. Continue to fund Respect the River, post signs, and use enforcement to mitigate impacts. Address camping areas and improve or continue adaptive management directly adjacent to spawning areas. Relocate/ close with timing restrictions those areas with direct impacts (*i.e.*, Icicle, Chiwawa, and White).

1.2 Instream Impacts

Agricultural Practices

1.2.1 Protect and improve riparian areas and floodplains. Work with local State, Federal, county, NRCS, and conservation district partners to improve habitat complexity, riparian areas, and floodplains, and conserve water for instream flows (Icicle, Peshastin, White, Chiwawa, and Wenatchee FMO). Improve water quantities in FMO areas to maintain complex habitat and connectivity. Improve water quality at agriculture return and reduce/eliminate interbasin transfer (*i.e.*, Icicle and Peshastin).

Forest Management Practices

1.2.2 Implement stream restoration projects in degraded stream reaches. Legacy forest practices have impacted most bull trout habitat and upstream tributaries. Identify and prioritize opportunities for stream restoration. Design and implement projects focusing on whole watershed restoration. National Forest lands and private lands containing bull trout habitat need to be assessed. Link to ongoing restoration activities with other planning processes as they relate to salmon and steelhead already in progress so as not to duplicate efforts. Restoration activities should focus on: increasing instream habitat complexity, off-channel habitat, and high flow refugia by adding large wood; managing riparian areas for a future supply of large wood, adequate shade; and repairing culverts, drainage, connectivity for passage and reducing fine sediment and water quality impacts from roads and other land use activities.

Dewatering (natural)

1.2.3 Reduce impacts from management to populations that have natural dewatering of spawning and rearing areas. Dewatering during times of low flow, impact amounts of available spawning habitat. Focus on minimizing impacts and protect watersheds in several populations (*i.e*., Icicle, Peshastin, and Nason) that are vulnerable to low flows. Research is needed to understand if natural due to long term impacts from legacy threats.

Entrainment

1.2.4 Develop adequate passage to connect FMO to spawning and rearing habitat while minimizing impacts to both bull trout and prey species. Entrainment occurs at the Columbia River hydropower dams (*i.e.*, Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids Dams). As well, there is entrainment in local populations (*i.e*., Icicle and Hatchery diversions, Chiwawa diversion, and historically Peshastin diversions). Continued focus should be on maintaining/improving upstream and downstream bull trout passage, reducing entrainment, and reducing habitat impacts. Research and ongoing monitoring is needed to determine and fix the screen/structures that are degraded, not functioning appropriately, or not in compliance.

Connectivity/Fish Passage

1.2.5 Connect FMO and spawning and rearing habitat. Columbia River hydropower dams, Icicle, Peshastin, Chiwawa River diversion dams or weirs; Dryden and Tumwater Dams; continue to block and impede passage. Rock dam building within some populations at campgrounds or developed areas also impede juvenile or sub-adults. Develop adequate passage to connect FMO and spawning and rearing habitat and maintaining critical habitat PCEs. Prioritize connecting FMO to spawning and rearing habitat (Columbia dams, Tumwater Dam, Icicle diversion/hatchery dams).

Mining

1.2.6 Implement and enforce good mining practices. Suction dredging occurs in several spawning and rearing areas (*i.e.*, Peshastin, Chiwawa). Develop HCP on Gold and Fish Pamphlet and work to reduce impacts to turbidity, sedimentation, riparian areas, and spawning gravels.

Residential Development and Urbanization

1.2.7 Reduce impacts from development. Current and future impacts include encroachment on floodplain and riparian habitat, impervious surface with poor runoff patterns, stormwater treatment, and water use. Spawning and rearing areas with areas of impact include Icicle, White, Nason (including Stevens Pass Ski area), and Chiwawa areas; FMO impacts occur in Wenatchee, Icicle, and at Lake Wenatchee.

Transportation Networks (e.g., major highways, railroads, etc.)

1.2.8 Reduce impacts to adjacent instream habitat, and remove passage barriers. Major Federal/State highways and railroads impact the Wenatchee, Icicle FMO and spawning and rearing areas in Nason, Peshastin, Chiwawa, and Chiwaukum, and other county roads impact instream habitat.

Altered Flows

1.2.9 Secure appropriate instream flows and move towards more natural flow regimes. Improving instream flows will help restore connectivity, decrease water temperatures and create higher quality habitat providing bull trout with more opportunities for migration and habitat for rearing. Wenatchee, Columbia FMO and some spawning and rearing in Icicle, Peshastin, and Chiwawa are degraded. Improve dams/diversions to leave more water in the channel by improving flow management, improving conveyance ditches, and head gate/diversion features. Prioritize connecting spawning and rearing with FMO habitats in Peshastin and Icicle populations.

Water Quality Impairment

1.2.10 Meet instream water quality standards. Improve water quality in diversion return flows in all areas of the Wenatchee Basin especially in 303d listed reaches (*i.e.*, Icicle, Peshastin, Little Wenatchee, and Wenatchee FMO).

Climate Change

1.2.11 Improve habitat complexity, water quality, and connectivity. FMO areas are lacking in habitat complexity, connectivity, while some lower/warmer spawning and rearing areas will need refuge and complex habitat. Focus on restoration that improves connectivity in all FMO and spawning and rearing areas (*i.e.*, between Wenatchee, Lake Wenatchee, and Columbia FMO and Icicle, Peshastin, Little Wenatchee, and Nason spawning and rearing areas).

1.3. Water Quality

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

Agriculture

2.1.1 Improve connectivity at both large and small diversion and improve water quality. See above for instream habitat connectivity/fish passage. Improve 303d listed reaches associated with agriculture. Stream temperature and agricultural chemicals have legacy and current impacts for connectivity of bull trout habitat (*i.e.*, Icicle, Peshastin, Wenatchee River, and other tributaries such as Mission and Chumstick that drain into FMO and critical habitat).

Forest Management

2.1.2 Improve and maintain forest roads to provide. Legacy and current forest management continues to impair connectivity in most habitats. Improve forest roads so that connectivity between spawning and rearing areas, and forage, migration, and overwintering habitat is accessible.

Dewatering (natural)

2.1.3 Reduce management impacts and improve access and timing of use. Natural dewatering occurs during low water years in Peshastin, Icicle, and Nason Creeks and can be further impacted with management and/or climate change. Insure riparian protections and instream flows are maintained to insure fish can migrate earlier if necessary. Minimize management impacts to these populations during low water years and improve connectivity downstream to insure timing for use of these streams is not restricted.

Entrainment (hydropower and diversions)

2.1.4 Reduce entrainment. Entrainment occurs at all mainstem Columbia River dams, Tumwater dam, Chiwawa diversion, and Icicle/Hatchery diversions. Correct entrainment issues. Improve monitoring efforts at Peshastin diversions to insure long term monitoring of new screens.

Fish Passage

2.1.5 Improve fish passage at all dams, smaller diversions, and at road crossings. Fish passage is fully or partially blocked; causing blocked or altered movement from downstream to upstream spawning/rearing and migration areas. Continue monitoring and adaptively managing PUD ladders on Columbia mainstem and improve downstream passage, develop both improved upstream and downstream passage at Tumwater/Dryden Dams; at Icicle, Chiwawa, and other diversions; and at Chiwawa Weir.

Transportation Networks

2.1.6 Reduced impacts from transportation networks. Improve management practices for maintenance and construction of roads. Transportation Networks impede passage and indirectly impairs connectivity habitat. Culverts, road locations, sediments, and chemical use directly impair connectivity corridors for most local populations.

Altered Flows

2.1.7 Improve stream flows to a more normative pattern so connectivity and refuge habitat are improved. Altered flows from Icicle and Hatchery diversions, Peshastin diversions, and other diversion on the mainstem Wenatchee or adjacent tributaries change flow patterns from normal patterns. Focus on Icicle, Peshastin to reduce altering migration timing and use.

Climate Change

2.1.8 Maintain/improve cool water refuge, water quality, and flows for movement. Climate change will alter stream flows, and increase temperatures impacting passage. Climate change is predicted to influence rain/snow patterns, stream flow patterns, and stream temperatures and cause reduced or limited use of migratory corridors in FMO habitats and spawning/rearing areas. Temperature barriers already exist in sections of the Wenatchee and Columbia River FMO and are expected to further degrade areas of spawning and rearing habitat.

2.2. Fisheries Management

Angling/Harvest

2.2.1 Reduce incidental catch and poaching. Incidental catch associated with open fisheries and poaching in closed areas impact populations in the Wenatchee Basin. Continue to develop and monitor fishing regulations and harvest rules to protect bull trout. Recreationists continue to misidentify bull trout. Continue to post signs/educate in camp grounds. Need research to understand impacts of incidental catch in other catch/keep fisheries. Illegal poaching is occurring in several basins (*i.e.*, Wenatchee R, Nason, Chiwawa, and Icicle areas). Develop enforcement plans to target incident areas.

Introduced Species

2.2.2 Continue to consider stocking of native species and reduction of brook trout a priority. Continue to provide good management and effective stocking plans that improve the native fish assemblages. Reduce (*i.e.*, Fish Lake and Columbia River have non-native brown trout and other species).

Fisheries Management

2.2.3 Reduce impacts from incidental catch during other fisheries monitoring activities. Use timing and equipment that reduce impacts. Increased fish management and need for monitoring associated with impacts caused by Federal Columbia River Power System causes increased handling and catch of bull trout. Identify and adjust management where species interactions may be an issue for populations of bull trout with low abundances.

2.3. Small Population Size

Genetic/Demographic Stochasticity

2.3.1. Improve genetic and demographic stochasticity. Improving passage and connectivity for populations to interact as a metapopulation will improve stochasticity. Insure resilience and redundancy. Half of the populations (Nason, Little Wenatchee, Icicle, and Peshastin) in the basin are small and unstable or stable at very low numbers. Legacy impacts caused disconnected habitat for migratory forms (Icicle, Nason, Chiwaukum, and Peshastin).

Loss/Altered Migratory Life History

2.3.2 Improve migratory life history connectivity. Life histories have been altered (*i.e.*, fluvial to adfluvial, or fluvial/adfluvial to resident) due to legacy impediment of fish passage. Populations above and below dams were disconnected from spawning areas for generations (*i.e.*, Icicle and Peshastin).

Fisheries Management

2.3.3 Reduce potential for negative species interactions in populations with low abundances. Species interactions from hatchery fish may be most impacting on populations with low numbers or in strongholds. Impacts from large native predators may be watch situations in Lake Wenatchee and the Wenatchee and Columbia Rivers (*i.e.*, Northern pike minnow). Research is needed to understand food webs in rivers and lakes.

2.4. Forage Fish Availability

Connectivity/Fish Passage

2.4.1 Improve forage fish opportunities. Hydropower and Irrigation dams and diversions, and other culverts block passage for potential native prey species. Manage passage for native fish assemblages with attention to impacts on small bull trout populations so impacts don't further reduce numbers.

Introduced Species

2.4.2 Reduce numbers of introduced species. Lake, brown, and brook trout outcompete for habitat and food, and hybridize with bull trout (Icicle, Chiwawa, Little Wenatchee, Columbia, and Wenatchee). Hybridization has been determined in several local populations. Competition for space and food occur when there is overlap with non-native species.

Fisheries Management

2.4.3 Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages. Hatchery releases may both impact (prey on and outcompete juvenile/subadult bull trout) and benefit (provide prey for adult bull trout) bull trout especially where low numbers of bull trout exist. Design species interaction studies to gather information and reduce bull trout impacts in Spawning and Rearing areas and areas used by sub-adults. Direct impacts occur as a result of operation of traps, weirs, from use of nets, and electro-shocking. Timing and methods of sampling should be considered to reduce impacts to bull trout.

3. Nonnative Fishes

3.1. Nonnatives

Introduced Species

3.1.1 Reduce numbers of introduced/non-native species. Non-native salmonids, and lake, brown, and brook trout out-compete bull trout for habitat and food, and brook trout hybridize with bull trout. Hybridization has been determined in several local populations. Competition for space and food occur when there is overlap with non-native species (*i.e.*, Icicle, Chiwawa, Little Wenatchee, Wenatchee, and Columbia).

Fisheries Management

3.1.2 Conduct fisheries management to reduce impact on bull trout. Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages. Hatchery releases may both impact (*i.e.*, predation, competition) and benefit (*i.e.*, provide preybase) bull trout (especially where low numbers of bull trout exist. Direct impacts occur as a result of operation of traps, weirs, from use of nets, and electro-shocking. Timing and methods of sampling can reduce impacts.

Climate Change

3.1.3 Plan for and reduce potential for increased non-native competitors. Prioritize non-native removal and habitat improvement where climate change will have the most impacts to cause increased abundances of non-native species (*i.e.*, brook trout, brown trout –fish lake/Columbia R; and legacy lake trout in Eightmile, Icicle; future northern pike in Columbia River).

4. Research, Monitoring, and Evaluation

4.1. Habitat

4.1.1 Develop action plan to evaluate habitat condition and determine bull trout potential for use. Use the upper Columbia Bull Trout Technical Workgroup to develop the action plan. Evaluate and conduct habitat surveys to determine current potential for use in other areas that fall out in the patch analysis. Include the development of patch analysis. Use analysis to assist developing baseline conditions in current and future habitats and to assist with brook trout removal risk analysis.

4.1.2 Continue to monitor key bull trout habitat with temperature probes for current conditions and effects of climate changes. Develop additional locations and maintain database for NorWeST temperature database.

4.1.3 Evaluate irrigation diversion screens. Prioritize and determine options for fixing screens that are degraded, not functioning appropriately, or not in compliance.

4.1.4 Evaluate low water areas in Nason, Icicle, Peshastin, and Little Wenatchee, to determine if natural or caused by management of flows or other ongoing threats.

4.1.5 Develop brook trout eradication and monitoring plan. Work to develop prioritized plan to eradicate and monitor effectiveness of removal techniques.

4.2. Demographic

4.2.1 Develop action plan to inform and assess current status of resident and migratory bull trout. Use the upper Columbia Bull Trout Technical Workgroup to develop the action plan. Continue to monitor trends in redd abundances. Develop a long term plan to determine changes in index areas, re-evaluate index areas, develop an estimate of total habitat surveyed, and an expansion factor for core area, etc.

4.2.2 Develop a long term monitoring program to assess distribution, status and trend of bull trout. Collaborate with partners to develop a rigorous and cost effective monitoring plan capable of detecting change in demographic metrics and effectiveness of recovery efforts. Include all life history stages to be able to develop population model. Coordinate with efforts to develop a region-wide monitoring plan.

4.2.3 Determine impacts of incidental catch in other catch/keep fisheries. Misidentification occurs in many areas and law enforcement has found bull trout are misidentified and kept.

4.2.4 Determine level of poaching. Illegal poaching is occurring in several basins (*i.e.*, Chiwawa, Nason, and Icicle). It is unknown how many may be taken.

4.2.5 Develop food web analysis and predator/prey relationship in Lake Wenatchee, rivers, and streams to identify preybase gaps or predator threats.

4.3. Non-natives

4.3.1 Determine distribution of brook, lake and brown trout. Brook trout distribution is not well defined. Determine the distribution of overlap with brook trout, lake trout, brown trout and other predatory species. Where sympatry is found to occur on the spawning grounds, evaluate rates of hybridization.

Conservation Recommendations

- Continue to support existing Upper Columbia Bull Trout Technical Work Group. Continue collaboration and coordination with partnership of Upper Columbia Fish and Wildlife Recovery Board, WDFW and the Service. Although the Service has no guidelines for format or process, the existing working group is largely informal, organized at the core area scale, and meets at least annually.

- Work to develop a bull trout recovery task funding mechanism.

- Develop whole watershed restoration planning. Connect the spawning and rearing habitat to the FMO (*i.e.*, National Forest streams and reaches to the lower mainstem/State/county/private lands) for increasing connectivity of complex habitat, reducing costs, reducing redundancy, and insuring goals for all species are met.

- Insure coordination with Columbia River Federal Power System and PUD FERC projects. Develop projects in a coordinated manor to reduce redundancy, reduce impacts to bull trout, for efficiency in spending funds. Mitigation for FCRPS such as habitat improvement projects has impacts to bull trout. Additional projects could be developed specifically for bull trout in coordination with other funding efforts. Explore opportunity for development of bull trout mitigation funding mechanism that would provide cost share opportunities and insure funding of projects upstream of salmon habitat.

Yakima River Core Area

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

Agriculture Practices

1.1.1. Maintain, restore, and protect riparian areas. Work with landowners, conservation districts, State, etc. to develop good management practices for riparian areas adjacent to spawning, rearing and forage/migration/overwintering habitats (*i.e.*, Ahtanum Creek, Teanaway, Yakima, and Naches Rivers).

Forest Management Practices

1.1.2 Maintain, restore, and protect riparian zones and stream channels associated with bull trout habitat. Along with ongoing implementation of the NW Forest Plan and implementation of the Forest Aquatic HCP on DNR lands implement specific forest practices and special use permits to protect and restore bull trout. Implement the Okanogan-Wenatchee Forest Restoration Strategy to protect and improve riparian reserves and stream channels as part of management planning. Develop, monitor, and adjust new Okanogan-Wenatchee National Forest Plan to incorporate at least these strategies and goals to insure protection of floodplains, riparian areas, and stream channels to maintain and restore bull trout habitat. As well, focus on land/water acquisitions that assist in improving riparian and instream habitats.

Livestock Grazing

1.1.3 Reduce grazing impacts. Fencing, changes in timing, and the use of riparian pastures, off site watering and salting, and other measures can be used to minimize grazing impacts. Evaluate ongoing allotment management for effects to bull trout and bull trout critical habitat. Modify management as needed, to reduce or eliminate effects that would retard recovery of bull trout populations and/or bull trout designated critical habitat. Conduct implementation and effectiveness monitoring, using accepted interagency monitoring protocols currently. Apply monitoring results to modify allotment management as necessary. Work with landowners in theTeanaway, Ahtanum Creek, Teanaway, Yakima, Tieton, and Naches Rivers below the forest boundary to reduce grazing impacts.

Residential Development and Urbanization

1.1.4 Reduce impacts to riparian and stream banks from residential development and urbanization. Residential developments cause reduced floodplain functions from runoff patterns, flood protection structures, and riparian area degradation. Work with cities, counties, COE to develop shoreline protection rules that minimize impacts to bull trout (*i.e.*, Yakima, Naches, Ahtanum, Gold Creek, Teanaway, etc.).

Transportation Networks (e.g., major highways, railroads, etc.)

1.1.5 Reduce habitat and floodplain impacts. Both spawning and rearing and FMO habitat are impacted by legacy and current Federal, State, and county highways (*i.e.*, Yakima, Teanaway, Naches/Little Naches, Tieton, American, Ahtanum, etc.). Location and management of roads constrict floodplains, create flooding issues, reduce habitat complexity and cause altered water quality and flow patterns.

Recreation

1.1.6 Reduce impacts from recreation to riparian areas and instream habitat. Riparian and floodplain impacts exist in large managed and dispersed camping areas in most local populations and some FMO habitats. Address closing, restoring, moving both dispersed and managed campsites especially in areas of spawning/rearing and large holding FMO habitats. Including public education/outreach is essential adjacent to large recreational areas (*i.e.*, Cle Elum, Kachess, Gold, Teanaway, American, Ahtanum, etc.).

1.2 Instream Impacts

Agricultural Practices

1.2.1 Protect and improve riparian areas and floodplains. Work with local State, Federal, county, NRCS, and conservation district partners to improve habitat complexity, riparian areas, and floodplains (Yakima, Naches, Teanaway, Ahtanum, etc.).

Forest Management Practices

1.2.2 Implement stream restoration projects in degraded stream reaches. Legacy forest practices have impacted bull trout habitat. Identify and prioritize opportunities for stream restoration. Design and implement projects focusing on whole watershed restoration. National Forest lands and private lands containing bull trout habitat need to be assessed. Link to ongoing restoration activities with other planning processes as they relate to salmon and steelhead already in progress so as not to duplicate efforts. Restoration activities should focus on: increasing instream habitat complexity, off-channel habitat, and high flow refugia by adding large wood; managing riparian areas for a future supply of large wood, adequate shade; and repairing culverts, drainage, connectivity for passage and reducing fine sediment and water quality impacts from roads and other land use activities. As well, focus on land/water acquisitions that assist in improving riparian and instream habitats.

Dewatering (natural)

1.2.3 <u>Reduce cumulative impacts in FMO to populations that are impacted during natural dewatering of spawning and rearing areas</u>. Dewatering during times of low flow, impact amounts of available spawning habitat. Focus on minimizing cumulative impacts to these populations when they are in FMO and protecting watersheds in several populations (*i.e.*, Gold, Deep, Box Canyon, Kachess, Ahtanum Creeks, and the Teanaway).

Livestock Grazing

1.2.4 <u>Reduce impacts to riparian areas and spawning reaches</u>. Legacy and current grazing practices have degraded riparian areas and had impacts to spawning areas from trampling. Current allotment management plans need ongoing maintenance, continued funding, and monitoring (*i.e.*, Teanaway, South Fork Tieton, Ahtanum and in areas of the FMO in the Yakima and Naches).

Entrainment

1.2.5 <u>Develop adequate passage to connect FMO to spawning and rearing habitat while minimizing impacts to both bull trout and prey species</u>. Entrainment of bull trout (and likely their prey species) occurs at Yakima Irrigation Project reservoir dams and diversions. Large BOR dams for the Yakima Irrigation Project on the Upper Yakima (Keechelus, Kachess, Cle Elum, and Easton) and in the Naches (Tieton and Clear Lake) and smaller diversion (*i.e.*, Roza, Prosser, Cowichee, and Wapato).. Screen issues occur in the Upper Yakima, Ahtanum, and Teanaway. Focus should be on maintaining/improving instream habitat and water quality, fish passage, and reducing entrainment, and maintaining old and placement of new screens. Research and monitoring is needed to determine and fix the screens that are degraded, not functioning appropriately, or not in compliance; on feed webs, and entrainment levels.

Connectivity/Fish Passage

1.2.6 <u>Connect FMO and Spawning and Rearing habitat</u>. Large Yakima Irrigation Project (BOR) Reservoir Dams block or impede fish migration to and from spawning areas. Other dams may have some form of passage but they are not built for bull trout and passage is impeded (*i.e.*, at Clear Lake, Easton, Roza, Prosser, etc. and at other diversion at certain times). Rock dams occur near areas of recreation (*i.e.*, Cle Elum, Teanaway, and American). Including enforcement and public education/outreach will be necessary to reduce numbers of user built rock dams. Culverts where there areas with high road miles in the watershed and within riparian areas (*i.e.*, Upper Yakima, Cle Elum, Teanaway, Little Naches, Cowiche, and Ahtanum) and other diversion dams impede or fully block fish passage. See Entrainment for additional BOR dams that impede/block passage. Develop adequate passage to connect FMO and spawning and rearing habitat and maintaining critical habitat PCEs. Prioritize connecting the Upper Yakima Basin due very low abundance and improving genetic diversity (esp. in Gold Creek).

Mining

1.2.7 <u>Implement and enforce good mining practices</u>. Suction dredging occurs in several spawning and rearing areas (*i.e.*, Cle Elum, Teanaway, and Kachess Rivers). Develop HCP on Gold and Fish Pamphlet and work to reduce impacts to turbidity, sedimentation, riparian areas, and spawning gravels.

Residential Development and Urbanization

1.2.8 <u>Reduce impacts from development</u>. Current and future impacts include encroachment on floodplain and riparian habitat, impervious surface with poor runoff patterns, stormwater treatment, and water use. Spawning and rearing areas with areas of impact include Lower Rattlesnake, Indian, American, Gold, Teanaway, and Upper Yakima. FMO areas with impact include Yakima and Naches Rivers, lower Ahtanum and Teanaway, and Upper Keechelus Lake near ski areas/second homes.

Transportation Networks (e.g., major highways, railroads, etc.)

1.2.9 <u>Reduce impacts to adjacent instream habitat, and remove passage barriers</u>. Major Federal/State highways impact the Yakima, Naches, American Rivers (Gold, Teanaway, Upper Yakima spawning areas and Yakima FMO) and other county roads impact instream habitat.

Altered Flows

1.2.10 <u>Secure appropriate instream flows and move towards more natural flow regimes</u>. Improving instream flows will help restore connectivity and FMO habitat or access to spawning and rearing habitat. It can improve water temperatures and create higher quality habitat for bull trout with more opportunities for migration and habitat for rearing. All FMO and some spawning and rearing are degraded by BOR and other irrigation projects and other legacy activities addressed above. Improve dams/diversions to leave more water in the channel by improving flow management, improving conveyance ditches, and headgate/diversion features (*i.e.*, Ahtanum (WHIP), Rattlesnake Diversion/pushup dam). Prioritize connecting the upper Yakima Basin.

Water Quality Impairment

1.2.11 Meet instream water quality standards. Improve water quality in diversion return flows in all areas of the Yakima Basin especially in 303d listed reaches. Implement TMDLs establish in Yakima Basin.

Climate Change

1.2.12 Improve habitat complexity, water quality, and connectivity. Climate change is evident in the Yakima Basin. FMO areas are lacking in habitat complexity, connectivity, while some lower/warmer spawning and rearing areas will need refuge and complex habitat. Focus on restoration that improves connectivity in all FMO and spawning and rearing areas in the Upper Yakima, Teanaway, Naches/Little Naches mainstems, and Ahtanum).

1.3. Water Quality

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

Agriculture

2.1.1 Improve connectivity at both large and small diversion and improve water quality. The Yakima basin has storage reservoir dams built as part of the Yakima Irrigation Project were built without fish passage. There is some work being done to begin to address the barriers through ESA Section 7 consultation and Yakima Basin Irrigation Project. See above for instream habitat connectivity/fish passage. The Yakima River and its tributaries have many 303d listed reaches. Stream temperature and Agriculture chemicals have legacy and current impacts for connectivity of bull trout habitat (*i.e.*, Yakima R, Teanaway R., and Ahtanum Creek.)

Forest Management

2.1.2 Improve and maintain forest roads to improve connectivity. Legacy and current forest management continues to impair connectivity. Decommission where necessary. Improve forest roads so that connectivity between spawning and rearing areas, and forage, migration, and overwintering habitat is accessible. Conduct hydrologic/geomorphic assessments in areas of past forest management particularly in areas of overlap with reservoir drawdowns to determine path forward to restore natural functioning channels and insure bull trout passage into spawning areas (*i.e.*, Indian, Gold, Box Canyon, Kachess).

2.1.3 Continue monitoring and implementation of grazing management plans (*i.e*., Ahtanum, S Fork Tieton, etc.). Grazing in spawning areas disrupts and causes trampling of redds.

Dewatering (natural)

2.1.4 Improve access and timing of use of spawning areas that are naturally dewatered. Natural dewatering occurs during low water years and can be further impacted with past or future management and in times of climate change. Insure riparian protections and instream flows are maintained to insure fish can migrate earlier if necessary. Minimize management impacts during low water years and improve connectivity downstream to insure timing for use of these streams is not restricted (*i.e.*, Ahtanum, Deep, Waptus, Gold, Teanaway). In areas where unsure if natural dewatering occurs, conduct hydrologic assessment similar to 2.1.2 to determine how much dewatering is natural or pertains to legacy management.

Entrainment (hydropower and diversions)

2.1.5 Reduce entrainment. Entrainment of bull trout and prey species may occur at all mainstem storage reservoirs and at other diversions throughout the Yakima Basin.

Fish Passage

2.1.6 Improve fish passage at all BOR dams, smaller diversions, and at road crossings. Upstream and downstream fish passage is fully or partially blocked; causing blocked or altered movement between spawning/rearing and forage, migration, and overwintering areas. Conduct hydrologic/geomorphic assessments as described in 2.1.3 especially adjacent to BOR reservoirs and past forest management. Work with water users and other partners to improve instream flows in reaches with significant water diversions. Where feasible, implement instream restoration to improve connectivity and improve passage for bull trout. Some smaller diversions have passage features and they should be assessed to insure passage can occur for all life history stages of bull trout.

Transportation Networks

2.1.7 Reduced impacts from transportation networks. Improve management practices for maintenance and construction of roads. Transportation Networks impede passage and indirectly impairs connectivity habitat. Culverts, road locations, sediments, and chemical use directly impair connectivity corridors.

Altered Flows

2.1.8 Improve stream flows to a more normative pattern so connectivity and refuge habitat are improved. Instream flows throughout the Yakima Basin from large reservoir management and other irrigation diversion withdrawals change flow patterns from normal patterns altering migration timing and use. Focus on maintaining flows necessary for all bull trout life histories, improving connectivity to and from spawning, rearing feeding, migration, and overwintering areas; and for maintaining bull trout prey base. Conduct food web studies to further define prey base impacts.

Limited Extent of Habitat

2.1.9 Reduce cumulative impacts to populations with limited habitat. Habitat is naturally limited for spawning and rearing in several local populations (*i.e.*, Deep, Box, Kachess, Gold). These populations have less resilience to other threats such as poaching, mortality from stream dewatering, and injury and displacement from entrainment at storage reservoirs or other diversions. Ensure connectivity and habitat conditions persist for use of all naturally available habitats. Focus on reducing management induced impacts to these populations that are already habitat limited.

Climate Change

2.1.10 Maintain/improve cool water refuge, water quality, and flows for movement. Climate change will alter stream flows, and increase temperatures impacting passage. Climate change is predicted to influence rain/snow patterns, stream flow patterns, and stream temperatures and cause reduced or limited use of migratory corridors in FMO habitats and spawning/rearing areas. Temperature barriers already exist in sections of FMO and are expected to further degrade (Upper Yakima, Ahtanum, and Teanaway).

2.2. Fisheries Management

Angling/Harvest

2.2.1 Reduce incidental catch and poaching. Incidental catch associated with open fisheries and poaching in closed areas continues to impact populations in the Yakima Basin. Continue to develop and monitor fishing regulations and harvest rules to protect bull trout. Recreationists continue to misidentify bull trout. Continue to post signs/educate in camp grounds. Need research to understand impacts of incidental catch in other catch/keep fisheries. Illegal poaching is occurring in several basins (*i.e.*, American, Deep, and Kachess). Develop enforcement and coordinated educational outreach plans to target incident areas.

Introduced Species

2.2.2 Continue to consider stocking of native species a priority. Continue to provide good management and effective stocking plans that improve the native fish assemblages.

Fisheries Management

2.2.3 Reduce impacts from incidental catch during other fisheries monitoring activities. Use timing and equipment that reduce impacts. Increased fish management and need for monitoring associated with impacts caused by Federal Columbia River Power System causes increased handling and catch of bull trout.

2.3. Small Population Size

Genetic/Demographic Stochasticity

2.3.1. Improve genetic and demographic stochasticity. Improving passage and connectivity for populations to interact as a metapopulation will improve stochasticity. Insure resilience and redundancy. Most populations (except S. Fork Tieton and Deep) in the basin are small and unstable or stable at very low numbers. Most are disconnected due to fish passage barriers at BOR's Yakima Basin Irrigation Project dams or other diversion. Due to the current low population sized develop reintroduction/translocation feasibility assessment, as described in the monitoring and assessment section at 4.2.7, and implement feasible actions to further improve the chance for recovery and connectivity within the core area.

Loss/Altered Migratory Life History

2.3.2 Improve migratory life history connectivity. Life histories have been altered (*i.e.*, fluvial to adfluvial, or fluvial/adfluvial to resident) due to long term impediment of fish passage. Populations above and below reservoirs are disconnected. Populations below reservoirs have been disconnected to spawning areas for generations and functional extirpation is occurring both below and above reservoirs (*i.e.*, Cle Elum, Teanaway). Continue efforts by BOR and partners to construct permanent passage facilities at storage reservoirs and develop instream flow strategies. Identify and implement interim passage strategies (*i.e.*, trap and haul) before permanent facilities are constructed. Strategies for reintroduction/translocation as developed as part of 2.3.1 above will assist with further refinement of this action. Similar to BORs work to assess passage and reconnect fluvial life history forms at Rimrock and Clear Lake, the dams in the Upper Yakima need to be assessed. The focus for bull trout should be given to the upper Yakima populations as they are rapidly declining.

2.4. Forage Fish Availability

Connectivity/Fish Passage

2.4.1 Improve forage fish opportunities. Yakima Irrigation Project dams, diversions, and other culverts block passage for potential native prey species. Manage for native fish assemblages with attention to impacts on small bull trout populations so impacts don't further reduce numbers.

Introduced Species

2.4.2 Reduce numbers of introduced species. Lake, brown, and brook trout and spiny ray species outcompete for habitat and food, and the char hybridize with bull trout (Upper Yakima, Kachess, Cle Elum, Waptus, NF Tieton, etc.). Hybridization has been determined in several local populations. Competition for space and food occur when there is overlap with non-native species.

Fisheries Management

2.4.3 Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages. Hatchery releases may both impact and benefit bull trout especially where low numbers of bull trout exist. Design species interaction studies to gather information and reduce bull trout impacts in Spawning and Rearing areas and areas used by sub-adults. Research is needed to understand food webs in rivers, streams, and reservoirs. Direct impacts occur as a result of operation of traps, weirs, from use of nets, and electro-shocking. Timing and methods of sampling should be considered to reduce impacts to bull trout.

3. Nonnative Fishes

3.1. Nonnatives

Introduced Species

3.1.1 Reduce numbers of introduced/non-native species. Lake, brown, and brook trout and spiny ray fish species out compete for habitat and food, and the char hybridize with bull trout (Upper Yakima, Kachess, Cle Elum, Waptus, NF Tieton, etc.). Hybridization has been determined in several local populations. Competition for space and food occur when there is overlap with non-native species. Both F1 and F2 hybrids have been identified in the basin.

Fisheries Management

3.1.2 Conduct fisheries management to reduce impact on bull trout. Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages. Hatchery releases may both impact (*i.e.*, predation, competition) and benefit (*i.e.*, provide preybase) bull trout (esp. where low numbers of bull trout exist. Direct impacts occur as a result of operation of traps, weirs, from use of nets, and electro-shocking. Timing and methods of sampling can reduce impacts.

Climate Change

3.1.3 Plan for and reduce potential for increased non-native competitors. Prioritize non-native removal and habitat improvement where climate change will have the most impacts to cause increased abundances of non-native species.

4. Research, Monitoring, and Evaluation

4.1. Habitat

4.1.1 Maintain Yakima Basin Action Plan to be able to prioritize risk and population recovery in the Yakima Core Area. Use the Yakima Basin Bull Trout Technical Workgroup to maintain the action plan.

4.1.2. Develop habitat baseline information for feasibility assessments for reintroduction/translocation and development of priority habitat projects. Include patch analysis to evaluate habitat condition and determine bull trout potential for use. Evaluate and conduct habitat surveys to determine current potential for use in Taneum, Swauk, Big, Cold, Cowiche, Nile, Oak, as well as other areas that fall out in the patch analysis. Also assess areas that are retained in patch analysis and the feasibility of maintaining or relocating populations. Use this analysis to assist with translocation/reintroduction and to develop baseline conditions in current and future habitats. Finish translocation/reintroduction feasibility assessment.

4.1.3 Continue to monitor key bull trout habitat with temperature probes for current conditions and effects of climate changes. Develop additional locations and maintain database for NorWeST temperature database.

4.1.4 Evaluate irrigation diversion screens. Prioritize and determine options for fixing screens that are degraded, not functioning appropriately, or not in compliance.

4.1.5 Continue to fund grazing management plan monitoring. Monitor and adjust practices to minimize impacts to bull trout. Substantial work has been done in several areas to reduce impacts on particular spawning tributaries. Monitoring and maintenance of fencing, water tanks, etc., is needed to insure adequate practices continue to improve habitat and protect bull trout in spawning and rearing areas. Especially include ongoing National Forest, State, and other grazing plans (*i.e.*, Tieton, Teanaway, Naches, and Ahtanum grazing plans).

4.1.6 Develop brook trout eradication and monitoring plan. Work to develop prioritized plan to eradicate and monitor effectiveness of removal techniques.

4.1.7 Develop feasibility assessment of implementing a nutrient enhancement plan and implement plan if warranted. Conduct food web task at 4.2.6 as part of assessment or before such a feasibility assessment is developed.

4.1.8 Maintain long term sediment monitoring in areas where fine sediment is identified as a limiting factor or impairs water quality in bull trout spawning and rearing areas.

4.2. Demographic

4.2.1 Continue to maintain Yakima Basin Action Plan population information to assess current status of resident and migratory bull trout. Use the Yakima Basin Bull Trout Technical Workgroup to maintain the action plan. Continue to monitor trends in redd abundances. Develop a long term plan to determine changes in Index Areas re-evaluate index areas, develop an estimate of total habitat surveyed, and an expansion factor for core area, etc.

4.2.2 Develop a long term monitoring program to assess distribution, status and trend of bull trout. Collaborate with partners to develop a rigorous and cost effective monitoring plan capable of detecting change in demographic metrics and effectiveness of recovery efforts. Include all life history stages to be able to develop population model. Coordinate with efforts to develop a region-wide monitoring plan.

4.2.3 Determine impacts of incidental catch in other catch/keep fisheries. Misidentification occurs in many areas and law enforcement has found bull trout are misidentified and kept.

4.2.4 Determine level of poaching. Illegal poaching is occurring in several basins (*i.e.*, American, Deep, and Kachess). It is unknown how many may be taken.

4.2.5 Develop population models necessary for recovering and building local populations. Establish population sizes necessary to be able to transfer fish from and what numbers are necessary to recover old and develop new populations. Evaluate the Yakima as a metapopulation and assess population dynamics that allow for buffering against local extirpation (*i.e.*, investigate whether individuals from large populations like South Fork Tieton can recolonize other populations nearby, such as Indian Creek, when there is a catastrophic mudflow). Include in the feasibility assessment to reintroduce/translocate bull trout at 4.1.7.

4.2.6 <u>Develop food web analysis and predator/prey relationship in reservoirs, lakes, rivers, and streams</u>. Identify preybase gaps, predator threats, or reduced impact operation scenarios for Yakima Irrigation Project management. Work has started on Kachess and Keechelus. Some work is occurring in Cle Elum as part of Sockeye reintroduction that can be combined with additional analysis. New studies need to be developed for Rimrock and Bumping reservoirs, Clear Lake, Easton Lake, and associated tributaries and mainstem rivers.

4.2.7 <u>Develop feasibility assessment for reintroduction/translocation of bull trout</u>. Include new and existing information from habitat and population conditions, fish health, genetics, and analysis of current and future conditions. Include a decision framework model to assist with identification of and assessment of risks to both current and future populations. As determined feasible, include a long term implementation and monitoring plans for any actions necessary for recovery in Yakima Basin. Coordination with fish agencies and the Yakima bull trout technical workgroup is essential.

4.2.8. <u>Evaluate options to facilitate use of bull trout habitat patches</u> identified in the Bull Trout Vulnerability Assessment by Jason Dunham. This may include in previously non-occupied or unknown habitat, or habitat upstream of barriers. Climate change may warrant investigation into these patches.

4.3. Non-natives

4.3.1 <u>Determine distribution of brook, lake and brown trout</u>. Brook trout distribution is not well defined. Determine the distribution of overlap with brook trout, lake trout, brown trout and other predatory species. Where sympatry is found to occur on the spawning grounds, evaluate rates of hybridization.

Conservation Recommendations

- <u>Continue to support existing Yakima Basin Bull Trout Technical Work Group</u>. Continue collaboration and coordination within that partnership and facilitation by Yakima Basin Fish and Wildlife Recovery Board, WDFW and the Service. Although the Service has no guidelines for format or process, existing working group is largely informal, organized at the core area scale and generally meets quarterly. Investigate formalizing the group.

- Work to develop a bull trout recovery task funding mechanism.

- Develop whole watershed restoration planning. Connect the spawning and rearing habitat to the FMO (*i.e.*, National Forest streams and reaches to the lower mainstem/State/county/private lands) for increasing connectivity of complex habitat, reducing costs, reducing redundancy, and insuring goals for all species are met.

- Insure coordination with Columbia River Federal Power System projects. Develop projects in a coordinated manor to reduce redundancy, reduce impacts to bull trout, and for efficiency in spending funds. Mitigation for FCRPS such as habitat improvement projects has impacts to bull trout. Additional projects could be developed specifically for bull trout in coordination with Integrated Planning. Explore a policy change to that FCRPS funding money could be used upstream of reservoirs. Explore opportunity for development of bull trout mitigation funding mechanism that would provide cost share opportunities.

- Develop coordinated educational/outreach programs.

Chelan Historic Core Area and Chelan Mainstem FMO Habitat

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

Agriculture Practices

1.1.1 Maintain, restore, and protect riparian areas. Lake Chelan has many large productive grape and fruit orchards. Work with landowners, conservation districts, State, etc. to develop good management practices for riparian areas. Legacy and continued use of pesticides impact water quality in Lake Chelan and have incurred 303d listing and restricted fish consumption warnings. Maintain complex habitat in lower Chelan River.

Forest Management Practices

1.1.2 Maintain, restore, and protect riparian zones and stream channels. Along with ongoing implementation of the NW Forest Plan, implement the Okanogan-Wenatchee Forest Restoration Strategy, to protect and improve riparian reserves and stream channels as part of planning. Legacy forest roads, fire management, and mining impact larger tributaries to the lake (*i.e.*, 25 Mile, Railroad, and tributaries on the North shore).

Livestock Grazing

1.1.3 Reduce grazing impacts. Legacy and current management plans should protect riparian areas and stream channels. Maintain or improve current standards in management plans. Evaluate ongoing allotment management for effects to bull trout and bull trout critical habitat. Modify management as needed, to reduce or eliminate impacts.

Residential Development and Urbanization

1.1.4 Reduce Impacts to riparian and stream banks from residential development and urbanization. Residential developments impacts have increased in the past 10 years with growth in the lower portion of Lake Chelan and on adjacent hillslopes. Impacts associated with development cause reduced floodplain functions from runoff patterns, flood protection structures, and riparian area degradation. Work with cities, counties, COE to develop shoreline protection rules that minimize impacts stream, lake and river riparian areas.

Recreation

1.1.5 Reduce impacts from recreation to riparian areas, shorelines, and instream habitat. Lake Chelan is a huge recreation area, with impacts mostly in the lower end of the lake and from boat docks, heavy boat traffic near mouths of tributaries and in shallow areas. In the Chelan River large pontoons of boats anchor near the mouth. Implement respect the river in the streams and lake and enforce boat regulations.

1.2 Instream Impacts

Agricultural Practices

1.2.1 Reduce impacts to water quality. Lake Chelan has had 303d listing from heavy use of pesticides in orchards. Instream flows and impacts from diversion alter habitat conditions and water quality. Develop safe pesticide and herbicide use plans and improve water quality in irrigation returns.

Forest Management Practices

1.2.2 Implement stream restoration projects in degraded stream reaches. Legacy forest practices have impacted larger tributaries on the North shore, 25 mile, Railroad, and sections of Stehekin River and associated upstream tributaries that are outside of wilderness. Design and implement projects focusing on whole watershed restoration. In the Chelan River, link to ongoing restoration activities with other planning processes as they relate to salmon and steelhead already in progress so as not to duplicate efforts. Restoration activities should focus on: increasing instream habitat complexity near mouths of tributaries to lake and in the Chelan River; repairing culverts, drainage, connectivity for passage and reducing fine sediment and water quality impacts from roads.

Entrainment

1.2.3 Connect Lake FMO to tributary habitat while minimizing impacts to native trout and prey species. Entrainment of fish can occur at the Chelan Dam, at the power house on the Chelan River, and at large Columbia River hydropower dams (*i.e.*, Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids Dams. Further research is needed to understand entrainment of native fish if any reintroduction of native trout including bull trout is to occur.

Connectivity/Fish Passage

1.2.4 Connect lake and river habitats. Maintain connectivity from lake into tributaries with reservoir management, and continue to improve connectivity from the Columbia River into the Chelan River focusing on all life history stages with a priority to sub-adult issues. Lake Chelan and the Chelan River will be a source of cool water and a potential refuge area as climate change occurs.

Transportation Networks (e.g., major highways, railroads, etc.)

1.2.5 Reduce impacts to adjacent instream habitat, and remove passage barriers. Major Federal/State highways impact the mouth of the Chelan River and other county roads impact habitat along the lake shore, 25 mile Creek, Stehekin River, etc. and will have ongoing impacts to floodplains, water quality, and flow patterns.

Altered Flows

1.2.6 Move towards more natural lake levels and flow regimes. The mouths of tributaries have some legacy issues related to pre FERC relicensing of the Chelan Dam, as well as current management that can cause impeded access. The mouth of Chelan River is influenced by levels of flow out of Lake Chelan. The Columbia River elevations, as a result of management of large hydropower projects, may at times impede passage. Explore how often, if and when, connectivity is an issue and move towards maintenance of connectivity for native salmonids.

Water Quality Impairment

1.2.7 Meet instream water quality standards. Improve water quality the Chelan Basin and Chelan River especially in 303d listed reaches for stream temperature, paying attention to levels of DO and any changes that might occur from climate change.

Climate Change

1.2.8 Improve habitat connectivity and quality in both Lake Chelan and the Chelan River. The upper end of Lake Chelan and the Chelan River with its cold water and glaciers may provide for long term refuge from climate change impacts. Maintain connectivity between tributaries and the lake and between the Columbia and Chelan River.

1.3. Water Quality

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

Agriculture

2.1.1 Improve connectivity at both large and small diversion and improve water quality. See above for instream habitat connectivity/fish passage. Improve 303d listed reaches associated with agriculture. Stream temperature and agricultural chemicals have legacy and current impacts for connectivity of bull trout habitat (Entiat and Columbia R and other tributaries that drain into FMO and critical habitat).

Forest Management

2.1.2 Improve and maintain forest roads to minimize ongoing impacts and improve connectivity. Legacy and current forest management continues to impair connectivity in most habitats. There is a very high road density in the Entiat. Improve forest roads so that connectivity between spawning and rearing areas, and forage, migration, and overwintering habitat is improved and accessible.

Entrainment (hydropower and diversions)

2.1.3 Reduce entrainment. To some degree, entrainment of adults and sub-adult bull trout occurs at all mainstem Columbia River dams, the Chelan dam, the Chelan powerhouse, and some diversions. FERC relicensing and settlement agreements have reduced or mitigated most impacts to bull trout. Ongoing management and monitoring is necessary to maintain a reduced threat. Maintain monitoring efforts at other diversions to insure function and long term monitoring of screens.

Transportation Networks

2.1.4 Reduced impacts from transportation networks. Improve management practices for maintenance and construction of roads. Transportation Networks along the Entiat River and at the mouth of the Entiat impede passage and indirectly impairs connectivity habitat. Culverts, road locations, sediments, and chemical use directly impair connectivity corridors for most local populations.

Altered Flows

2.1.5 Improve reservoir levels and flows in Chelan River to more normative patterns. Connectivity impacts are the result of changing lake levels with the operation of Chelan Dam and supplying water to the Chelan River, and operations in the Columbia River at large hydropower dams. To restore native populations including bull trout, work to maintain connectivity of lake with tributaries.

Climate Change

2.1.6 Maintain/improve connectivity to Lake Chelan and Chelan River. Climate change will alter stream flows, and increase temperatures impacting passage. Climate change is predicted to influence rain/snow patterns, stream flow patterns, and stream temperatures and cause reduced or limited use of migratory corridors in FMO habitats and spawning/rearing areas. Temperature barriers already exist in sections of the Columbia and within other core areas. The Chelan basin is predicted to maintain its glaciers and cool water refuge. Research/manage for native fish assemblages including determining use as possible refuge.

2.2. Fisheries Management

Angling/Harvest

2.2.1 Reduce incidental catch and poaching. Incidental catch associated with open fisheries and poaching in closed areas impact populations in the upper Columbia River core areas. Continue to develop and monitor fishing regulations and harvest rules to protect bull trout and prey. Recreationists continue to misidentify bull trout. Continue to post signs/educate in camp grounds. Need research to understand impacts of incidental catch in other catch/keep fisheries in Columbia FMO areas. Research to understand if poaching occurs in Columbia River or at mouth of Chelan River. Develop enforcement plans to target incident areas.

Introduced Species

2.2.2 Continue to consider stocking of native species and make reduction of lake trout and brook trout a priority. Continue to provide good management and effective stocking plans that improve the native fish assemblages. Watch for invasions of lake trout coming out of Lake Chelan, brown trout, or other spiny ray species in Columbia River. Conduct research to understand predation rates on sub-adult bull trout in in Chelan River and Columbia River.

Fisheries Management

2.2.3 Reduce impacts from incidental catch during other fisheries monitoring activities. Use timing and equipment that reduce impacts. Increased fish management and need for monitoring associated with impacts caused by Federal Columbia River Power System can cause increased handling and catch of bull trout in Columbia and Chelan River FMO. Identify and adjust management where species interactions may be an issue for populations of bull trout with low abundances. Lake trout, northern pike minnow and brook trout fisheries could encounter bull trout, thus there is a need for continued monitoring to understand impacts and increased education for proper species identification.

2.3. Small Population Size

Loss/Altered Migratory Life History

2.3.1 Improve migratory life history connectivity for native/bull trout. Life histories have been altered due to legacy impediment of fish passage. Lake Chelan has had long term passage impairment into the Chelan River from operation of Chelan Power house and Legacy impacts from management of Lake Chelan levels causing impeded passage into tributary streams once known for bull trout spawning (*i.e.*, Prince and Fish Creeks) and likely other forage tributaries.

Fisheries Management

2.3.2 Reduce potential for negative species interactions on small native/bull trout populations. Species interactions from hatchery fish may be most impacting on populations with low numbers that use the Columbia or Chelan Rivers (*i.e.*, Entiat). Impacts from large native predators may be a watch out situations in the Columbia Rivers (*i.e.*, Lake trout from Lake Chelan, Northern pike minnow). Research is needed to understand food webs in rivers and lakes.

2.4. Forage Fish Availability

Connectivity/Fish Passage

2.4.1 Improve forage fish opportunities. Hydropower and Irrigation dams and diversions, and other culverts block passage for potential native prey species. Manage passage for native fish assemblages.

Introduced Species

2.4.2 Reduce numbers of introduced species. Lake and brook trout outcompete for habitat and food, and/or hybridize with bull trout. Competition for space and food occur when there is overlap with non-native species. Develop brook trout and lake trout reduction/removal plan.

Fisheries Management

2.4.3 Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages. Hatchery releases may both impact (prey on and outcompete juvenile/subadult bull trout) and benefit (provide prey for adult bull trout) bull trout especially where low numbers of bull trout exist. Design species interaction studies to gather information and reduce bull trout impacts areas used by sub-adults. Direct impacts occur as a result of operation of traps, weirs, from use of nets, and electro-shocking. Timing and methods of sampling should be considered to reduce impacts to bull trout.

3. Nonnative Fishes

3.1. Nonnatives

Introduced Species

3.1.1 Reduce numbers of introduced/non-native species. Non-native salmonids, such as brook and lake trout outcompete native species and bull trout for habitat and food, and brook trout hybridize with bull trout. Hybridization has been determined in areas of overlap. Competition for space and food occur when there is overlap with non-native species (Columbia R, Chelan R, and Lake Chelan).

Fisheries Management

3.1.2 Conduct fisheries management to reduce impact on native/bull trout. Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages. Hatchery releases may both impact (*i.e.*, predation, competition) and benefit (*i.e.*, provide preybase) bull trout (esp. where low numbers of bull trout exist. Direct impacts occur as a result of operation of traps, weirs, from use of nets, and electro-shocking. Timing and methods of sampling can reduce impacts.

Climate Change

3.1.3 Plan for and reduce potential for increased non-native competitors. Prioritize non-native removal and habitat improvement where climate change will have the most impacts and will cause increased abundances of non-native species (*i.e.*, lake trout, brook trout; future northern pike in Columbia River).

4. Research, Monitoring, and Evaluation

4.1. Habitat

4.1.1 Develop action plan to evaluate habitat condition and determine bull trout potential use. Evaluate and conduct habitat surveys to determine current potential for use in other areas that fall out in the patch analysis. Include patch analysis. Use analysis to assist developing baseline conditions in current and future habitats and to assist with brook trout removal risk analysis.

4.1.2 Develop monitoring plan to monitor potential native species habitat with temperature probes for current conditions and effects of climate changes. Develop additional locations and maintain database for NorWeST temperature database.

4.1.3 Develop brook trout and lake trout eradication/reduction plan. Work to develop prioritized plan to eradicate and monitor effectiveness of removal techniques.

4.1.4 Continue research to understand the entrainment of native species at Chelan Dam and Chelan Power house. Determine of any diversion screens cause entrainment in tributaries to Lake Chelan.

4.2. Demographic

4.2.1 Develop action plan to inform and assess current status of bull trout in Lake Chelan and its tributaries, and to identify amount of use of Chelan River.

4.2.3 Determine impacts of incidental catch of native trout in other catch/keep fisheries in Lake Chelan, its tributaries, and near mouth of Chelan River. Misidentification occurs in many areas and law enforcement has found bull trout are misidentified and kept.

4.2.4 Determine if poaching occurs. Illegal poaching is occurring in several areas. It is an unknown threat in Lake Chelan, Columbia River and Chelan River. Historically, bull trout were blasted out of pools and caught in commercial fisheries in Lake Chelan.

4.2.5 Develop food web analysis and predator/prey relationship in Columbia, Chelan R, and Lake Chelan to identify preybase gaps or predator threats.

4.3. Non-natives

4.3.1 Determine distribution of brook trout and lake trout. Brook trout distribution is not well defined. Determine the distribution of overlap with brook trout, lake trout, brown trout and other predatory species. Where sympatry is found to occur, evaluate rates of competition.

Conservation Recommendations

- Continue to support existing Upper Columbia Bull Trout Technical Work Group. Continue collaboration and coordination with partnership of Upper Columbia Fish and Wildlife Recovery Board, WDFW and the Service. Although the Service has no guidelines for format or process, the existing working group is largely informal, organized at the core area scale, and meets at least annually.

- Work to develop a bull trout recovery task funding mechanism. Develop whole watershed restoration planning. Connect the spawning and rearing habitat to the FMO (*i.e.*, National Forest streams and reaches to the lower mainstem/State/county/private lands) for increasing connectivity of complex habitat, reducing costs, reducing redundancy, and insuring goals for all species are met.

- Insure coordination with Columbia River Federal Power System project and FERC relicensing projects. Develop projects in a coordinated manor to reduce redundancy, reduce impacts to bull trout, for efficiency in spending funds.

Okanogan River FMO Habitat

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

Agricultural Practices

1.1.1 Protect and improve riparian areas and floodplains. Work with local State, Federal, county, NRCS, and conservation district partners to improve habitat complexity, riparian areas, and floodplains areas.

Forest Management Practices

1.1.2 Maintain, restore, and protect riparian zones. Along with ongoing implementation of PacFish/InFish, implement the Okanogan-Wenatchee Forest LRMP and Restoration Strategy to protect and improve riparian reserves and stream channels.

Livestock Grazing

1.1.3 Reduce grazing impacts. Fencing, changes in timing, and the use of riparian pastures, off site watering and salting, and other measures can be used to minimize grazing impacts. Work with allotment plans above and below the forest boundary and other to reduce grazing impacts.

Residential Development and Urbanization

1.1.4 Reduce Impacts to riparian and stream banks from residential development and urbanization. Residential developments cause reduced floodplain functions from runoff patterns, flood protection structures, and riparian area degradation. Work with cities, counties, COE to develop shoreline protection rules that minimize impacts to FMO habitat.

Transportation Networks (e.g., major highways, railroads, etc.)

1.1.5 Reduce habitat and floodplain impacts. FMO habitats are impacted by current Federal, State, and county highways. Location and management of roads constrict floodplains, create flooding issues, reduce habitat complexity and cause altered water quality and flow patterns.

1.2 Instream Impacts

Forest Management Practices

1.2.1 Implement stream restoration projects in degraded stream reaches. Legacy forest practices have impacted most bull trout habitat and upstream tributaries. Identify and prioritize opportunities for stream restoration. Design and implement projects focusing on whole watershed restoration. National Forest lands and private lands containing bull trout habitat need to be assessed. Link to ongoing restoration activities with other planning processes as they relate to salmon and steelhead already in progress so as not to duplicate efforts. Restoration activities should focus on: increasing instream habitat complexity, off-channel habitat, and high flow refugia by adding large wood; managing riparian areas for a future supply of large wood, adequate shade,; and repairing culverts, drainage, connectivity for passage and reducing fine sediment and water quality impacts from roads and other land use activities.

Entrainment

1.2.2 Develop adequate passage to connect FMO habitats and the Okanogan with Columbia River FMO habitat. Maintain/ improve fish passage, and reducing entrainment. Research and ongoing monitoring is needed to determine and fix the screen/structures that are degraded, not functioning appropriately, or not in compliance.

Connectivity/Fish Passage

1.2.3 Connect FMO and Spawning and Rearing habitat. Fish passage is impeded at Zosel Dam on Osoyoos Lake. Continue to improve passage at Zosel and other dams and diversions, and road culverts focusing on all life history stages with a priority to sub-adult issues.

Transportation Networks (e.g., major highways, railroads, etc.)

1.2.4 Reduce impacts to adjacent instream habitat, and remove passage barriers. Major Federal/State highways impact the Okanogan River and other county roads impact instream habitat and will have ongoing impacts to floodplains, water quality, and flow patterns.

Altered Flows

1.2.5 Secure appropriate instream flows and move towards more natural flow regimes. Improving instream flows will help restore connectivity, decrease water temperatures and create higher quality habitat providing bull trout with more opportunities for migration and habitat for rearing. Continue to increase efficiency of diversions to leave more water in the channel by improving flow management, improving conveyance ditches, and headgate/diversion features. Dams in Canada, Zosel Dam, and diversions have altered flows. The mouth of the Okanogan River is influenced by Columbia River elevations and may impede passage (*i.e.*, low flows or thermal barriers) as a result of management of large hydropower projects.

Water Quality Impairment

1.2.6 Meet instream water quality standards. Improve water quality the Okanogan Basin and Columbia River especially in 303d listed reaches for stream temperature, turbidity, DO, etc. Irrigation returns, runoff, application of pesticides/herbicides/ de-icer impacts adjacent FMO lead to poor water quality.

Climate Change

1.2.7 Improve habitat complexity, water quality, and connectivity. FMO areas are lacking in habitat complexity, connectivity. Some lower/warmer areas will need islands of refuge habitat. Focus on restoration that improves connectivity.

1.3. Water Quality

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

Agriculture

2.1.1 Improve connectivity at both large and small diversion and improve water quality. See above for instream habitat connectivity/fish passage. Improve 303d listed reaches associated with agriculture. Stream temperature and Agriculture chemicals have legacy and current impacts for connectivity of bull trout habitat.

Forest Management

2.1.2 Improve and maintain forest roads to provide passage and hydraulic connectivity. Improve forest roads so that forage, migration, and overwintering habitat are improved and accessible.

Entrainment (hydropower and diversions)

2.1.3 Reduce entrainment. Entrainment occurs at all mainstem Columbia River dams, and some diversions. Correct entrainment issues. Maintain monitoring efforts to insure long term monitoring of new screens.

Fish Passage

2.1.4 Improve fish passage at all dams, smaller diversions, and at road crossings. Fish passage is fully or partially blocked; causing blocked or altered movements. Continue monitoring and adaptively managing ladders on Zosel Dam and improve downstream passage.

Transportation Networks

2.1.5 Reduce impacts from transportation networks. Improve management practices for maintenance and construction of roads. Transportation Networks along Okanogan River and impede passage and indirectly impairs FMO habitat. Culverts, road locations, sediments, and chemical use directly impair connectivity corridors for most local populations.

Climate Change

2.1.6 Maintain/improve cool water refuge, water quality, and flows for movement. Climate change will alter stream flows, and increase temperatures impacting passage. Climate change is predicted to influence rain/snow patterns, stream flow patterns, and stream temperatures and cause reduced or limited use of migratory corridors in FMO habitats. Temperature barriers already exist in sections of the Okanogan and Columbia River FMO and are expected to further degrade.

2.2. Fisheries Management

Angling/Harvest

2.2.1 Reduce incidental catch. Incidental catch associated with open fisheries impact populations in the upper Columbia and Okanogan FMO areas. Continue to develop and monitor fishing regulations and harvest rules to protect bull trout. Recreationists continue to misidentify bull trout. Continue to post signs/educate in camp grounds. Need research to understand impacts of incidental catch in other catch/keep fisheries (*i.e.*, Sockeye, Chinook, and steelhead) in Okanagan and Columbia FMO areas and if there is any poaching issues.

Introduced Species

2.2.2 Continue to consider stocking of native species and reduction of brook trout and non-native salmonids a priority. Continue to provide good management and effective stocking plans that improve the native fish assemblages. Okanogan and Columbia River FMO has high levels of predatory introduced species (*i.e.*, bass, walleye, and other spiny ray species). Implement brook trout removal plans in high risk area. Watch for invasions in Okanogan and Columbia River FMOs from new predators.

Fisheries Management

2.2.3 Reduce impacts from incidental catch during other fisheries monitoring activities. Use timing and equipment that reduce impacts. Increased fish management and need for monitoring associated with impacts caused by Federal Columbia River Power System causes increased handling and catch of bull trout. Identify and adjust management where species interactions may be an issue for populations of bull trout with low abundances. Need to understand impacts and adjust management where appropriate.

2.3. Small Population Size

Loss/Altered Migratory Life History

2.3.2 Improve migratory life history connectivity. Life histories have been altered due to legacy impediment of fish passage. Populations above and below Okanagan and Columbia River dams were and continue to be disconnected from spawning areas. Dams in Canada also impeded and blocked migratory life history forms. There is a research need to determine if any spawning habitat exists in the Okanogan basin in Washington or how it might be connected to Canadian core areas.

Fisheries Management

2.3.3 Reduce potential for negative species interactions. Species interactions from hatchery fish may have greatest impacts on populations with low numbers or in strongholds. Impacts from large native predators may be watching out situations in the Columbia Rivers (*i.e.*, Northern pike minnow). Research is needed to understand food webs in rivers and lakes.

2.4. Forage Fish Availability

Connectivity/Fish Passage

2.4.1 Improve forage fish opportunities. Hydropower and Irrigation dams and diversions, and other culverts block passage for potential native prey species. Manage passage for native fish assemblages with attention to impacts on small bull trout populations so impacts don't further reduce numbers. Develop food web studies to understand extent of prey impacted, and levels of entrainment.

Introduced Species

2.4.2 Reduce numbers of introduced species. Brook trout out compete for habitat and food, and hybridize with bull trout. Competition for space and food occur when there is overlap with non-native species. Develop brook trout removal plan.

Fisheries Management

2.4.3 Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages. Hatchery releases may both impact (prey on and outcompete juvenile/subadult bull trout) and benefit (provide prey for adult bull trout) bull trout especially where low numbers of bull trout exist. Design species interaction studies to gather information and reduce bull trout impacts in Spawning and Rearing areas and areas used by sub-adults. Direct impacts occur as a result of operation of traps, weirs, from use of nets, and electro-shocking. Timing and methods of sampling should be considered to reduce impacts to bull trout.

3. Nonnative Fishes

3.1. Nonnatives

Introduced Species

3.1.1 Reduce numbers of introduced/non-native species. Non-native salmonids, brook trout, and spiny ray species out-compete bull trout for FMO, and brook trout hybridize with bull trout. Hybridization has been determined where there are areas of overlap. Competition for space and food occur when there is overlap with non-native species.

Fisheries Management

3.1.2 Conduct fisheries management to reduce impact on bull trout. Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages. Hatchery releases may both impact (*i.e.*, predation, competition) and benefit (*i.e.*, provide preybase) bull trout (esp. where low numbers of bull trout exist. Direct impacts occur as a result of operation of traps, weirs, from use of nets, and electro-shocking. Timing and methods of sampling can reduce impacts.

Climate Change

3.1.3 Plan for and reduce potential for increased non-native competitors. Prioritize non-native removal and habitat improvement where climate change will have the most impacts to cause increased abundances of non-native species. Watch for new non-native invasions (*i.e.*, brook trout; future northern pike in Columbia River).

4. Research, Monitoring, and Evaluation

4.1. Habitat

4.1.1 Develop action plan to evaluate habitat condition and determine potential bull trout habitat. Include the Canadian portion of the Okanogan in collaboration. Evaluate and conduct habitat surveys to determine current potential for use in other areas that fall out in the patch analysis. Include patch analysis. Use analysis to assist developing baseline conditions in current and future habitats and to assist with brook trout removal risk analysis.

4.1.2 Monitor FMO habitat with temperature probes for current conditions and effects of climate changes. Develop additional locations and maintain database for NorWeST temperature database.

4.1.3 Evaluate irrigation diversion screens. Prioritize and determine options for fixing screens that are degraded, not functioning appropriately, or not in compliance.

4.1.4 Develop brook trout eradication and monitoring plan. Work to develop prioritized plan to eradicate and monitor effectiveness of removal techniques.

4.2. Demographic

4.2.1 Develop action plan to inform and assess current status of bull trout in Okanogan River and its tributaries, and to identify amount of use Okanogan River.

4.2.2 Determine impacts of incidental catch in other catch/keep fisheries. Misidentification occurs in many areas and law enforcement has found bull trout are misidentified and kept.

4.2.3 Develop food web analysis and predator/prey relationship in Okanogan River and Osoyoos Lake to identify preybase gaps or predator threats.

4.3. Non-natives

4.3.1 Determine distribution of brook trout. Brook trout distribution is not well defined. Determine the distribution of brook trout and other predatory species.

Conservation Recommendations

- Continue to support existing Upper Columbia Bull Trout Technical Work Group. Continue collaboration and coordination with partnership of Upper Columbia Fish and Wildlife Recovery Board, WDFW and the Service. Although the Service has no guidelines for format or process, the existing working group is largely informal, organized at the core area scale, and meets at least annually.

- Work to develop a bull trout recovery task funding mechanism.

- Develop whole watershed restoration planning. Connect the spawning and rearing habitat to the FMO (*i.e.*, National Forest streams and reaches to the lower mainstem/State/county/private lands) for increasing connectivity of complex habitat, reducing costs, reducing redundancy, and insuring goals for all species are met.

- Insure coordination with Columbia River Federal Power System and PUD FERC Projects and Trans boundary Treaty Negotiations. Develop projects in a coordinated manor to reduce redundancy, reduce impacts to bull trout, for efficiency in spending funds.

Northeastern Washington Research Needs Area

1. Actions to Address Habitat Threats

None

2. Actions to Address Demographic Threats

None

3. Actions to Address Nonnative Fishes

None

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.1.1 Develop list of suitable habitat patches that provide potential spawning and rearing habitat and conduct surveys and evaluations. Use tools such as the 2015 Bull Trout Vulnerability Assessment (Dunham 2015) and Climate Shield Analysis (Isaak *et al*. 2015) to assist in prioritizing focal streams.

4.2 Demographic

4.2.1 Develop genetic inventory. Develop a genetic inventory of bull trout collected throughout the entire Research Area to identify source populations and/or the presence of new populations. Work cooperatively with permitting agencies to develop agreements for researchers, fishing charters, and others to collect genetic samples, location information, and biometric data.

4.2.2 Develop a records compilation. Collect Tribal oral histories and observation data to identify areas of historical and potential new populations. Use identified areas for focusing restoration actions and targeting biological surveys for bull trout.

4.2.3 Collect eDNA samples at focal tributaries. Develop protocol and collect eDNA samples in tributary mouths and in areas above natural barriers. Collect samples in tributaries that have sufficient habitat, lack historical information, or infrequent observations of bull trout occur, including but not limited to, the Sanpoil, Kettle, and Spokane Rivers, Crown, Onion, Big Sheep, Sherman, Ninemile, Wilmont, and Stranger Creeks on the Columbia River, and Cedar, Fish, and Russian Creeks on the Pend Oreille River. Use resulting data to complete more comprehensive surveys in targeted streams.

4.3 Non-natives

4.3.1 Develop a strategy to reduce non-natives and reduce potential invasion by predatory species such as northern pike and lake trout present in watersheds upstream.

Lower Snake Geographic Region

Clearwater River Core Areas

Note: Actions described in sections 1.0, 2.0, and 3.0 below address primary threats to the South Fork Clearwater core area. Actions described in sections 4.0 (Research, Monitoring, & Evaluation) and Conservation Recommendations apply to all four of the Clearwater River core areas, as well as shared FMO habitat in the mainstem Clearwater River.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

Forest Management Practices

1.1.1 Reduce fine sediment production. Reduce fine sediment sources from agriculture and forest management practices. Stabilize roads, road stream crossings, landslides and other known sources of sediment delivery. Implement recommendations from the U.S. Forest Service and Bureau of

Land Management Watershed Analyses and other plans that are geared to remediation of sediment production. Implement Best Management Practices in timber sale planning to minimize sediment production associated with logging activities. Priority watersheds include those with known or potential bull trout populations and that are designated critical habitat. Roads constructed for logging and mining are a constant source of sediment in the Red River; American and Crooked Rivers; and Newsome Creek.

1.1.2 Address forest road maintenance and areas with high sediment loading. Improve roads that negatively impact water quality by removal, access restrictions, making alternative routes, and/or upgrading roads and applying all maintenance procedures. Emphasize maintenance of extensive U.S. Forest Service road systems by increased application of Best Management Practices, with a focus on remediation of sediment producing hotspots, and maintenance of bridges, culverts, and crossings in drainages supporting bull trout spawning and rearing. Decommission/remove surplus forest roads: especially those that are chronic sources of fine sediment and/or those located in areas of highly erodible geological formations. Remove culverts and/or bridges on closed roads that are no longer maintained.

1.1.3 Improve maintenance along transportation corridors. The maintenance of all major roads along riparian corridors should be improved to reduce impacts of fine sediment and floodplain encroachment. Whenever possible, relocate problem (high sediment-producing) road reaches out of riparian corridors. Locate all dump areas for excess road material in stable upland areas away from stream/riverbeds. Priority areas include Highway 14 corridor along the South Fork Clearwater River and U.S. Forest Service Road 233 along Crooked River.

1.1.4 Restore areas degraded by historical timber harvest. Legacy impacts from timber harvest include lack of riparian trees and vegetation, high road densities, large areas of clearcuts, altered hydrologic regimes including increased peak flows, and other impacts that have created excessive fine sediment sources for watersheds. Potential restoration treatments include channel stabilization, riparian and upland plantings, placement of instream woody debris, etc. The following drainages have been degraded by historic timber harvest and have embedded and de-stabilized streams: Red River, American and Crooked Rivers, and Newsome Creek.

1.1.5 Revegetate denuded riparian areas. Develop site specific plans to promote revegetation of riparian areas to ensure sufficient shade and canopy, large woody debris recruitment, riparian cover, and native vegetation are present to support native salmonids. Highest priority is on streams with existing bull trout populations. Revegetate riparian areas affected by logging in: lower Red River, Crooked River along U.S. Forest Service Road #233, mainstem of upper South Fork Clearwater River.

1.1.6 Restore riparian areas where livestock grazing is impacting bull trout habitat. Fence riparian areas to eliminate riparian degradation from grazing in problem areas. Priority areas include private land in lower Elk Creek (American River tributary); private land in lower and middle portions of the Red River.

1.1.7 Implement restoration actions areas in which secondary roads have been constructed in the floodplain. These roads have displaced riparian vegetation and are a constant source of fine sediment to the streams. Appropriate remedial measures should be developed and implemented. Priority areas include those in occupied bull trout habitat: Red, Crooked, and American Rivers, and Newsome Creek.

1.1.8 Compensate for legacy timber harvest and associated roading practices. Continue to mitigate for the legacy of intensive timber harvest and poor silvicultural and road construction practices in steep and highly erosive canyon breaklands. Past clearcutting practices and high density jammer-type road systems have resulted in mass wasting events and continued erosion and sediment introduction into bull trout habitat. Practices such as replanting, obliterating roads, and improving maintenance of roads should be continued and new techniques implemented. Priority areas include the Red River, Newsome Creek, and American River.

1.1.9 Integrate watershed restoration efforts on public and private lands. Integrate watershed analyses and restoration activities on public lands in the headwaters and private lands, which occur primarily lower in the watershed, to ensure that activities maximize benefits and are complementary to bull trout restoration (*e.g.*, Red, American, and Crooked Fork Rivers).

1.2. Instream Impacts

Altered flows and geomorphic processes

1.2.1 Identify problem mine sites and remediate tailings, ponds, and other associated waste. Control mining runoff from roads, dumps, and ponds, and remove and stabilize mine tailings and waste rock deposited in the stream channel and floodplains and restore stream channel function. Priority watersheds include Newsome Creek and Crooked River, followed by Red, American and mainstem South Fork Clearwater Rivers.

1.2.2 Restore stream reaches degraded by dredge and placer mining. Mining activities have been extensive in the Crooked and American River, and

Newsome Creek watersheds, and to a lesser degree in the Red River watershed. Restoration of mainstem reaches is critical to improving connectivity for fluvial fish between local populations in this core area. Restoration of lower and middle Crooked River and Newsome Creek is a high priority.

1.2.3 Improve instream habitat. Conduct stream restoration in areas impacted by legacy and ongoing road effects, logging, agriculture, grazing, and urban development, stream cleaning, and mining. Increase or improve instream habitat by restoring recruitment of large woody debris, pools, or other appropriate habitat, wherever the need is identified. Priority watersheds include the upper South Fork Clearwater mainstem, American, Red and Crooked Rivers and Newsome Creek.

1.2.4 Improve stream channels near transportation corridors. Improve stream conditions where current and legacy highway and railroad encroachment, channel straightening, channel relocation, and undersized bridges exist. Initial areas to focus efforts include: South Fork Clearwater Highway 14 corridor.

1.2.5 Implement restoration of overwintering habitat in the mainstem river. Implement necessary restoration activities to improve overwintering habitat in the South Fork Clearwater River.

1.2.6 Provide long-term protection of perennial stream reaches. Work cooperatively with private landowners and the Natural Resource Conservation Service to provide voluntary incentives for long-term habitat protection. Some habitat important for bull trout recovery, especially migratory, foraging, and overwintering habitats, occur on private lands and may need protection to maintain conditions conducive to bull trout recovery. A variety of cooperative arrangements could be made with landowners to protect and restore habitat on their land. Where possible, coordinate and combine efforts for bull trout and anadromous fish recovery efforts. Initial emphasis should be placed on identified bull trout spawning and rearing streams. Priority areas include Red and American Rivers and Newsome Creek.

1.2.7 Identify opportunities for habitat restoration and provide assistance to landowners. Some important bull trout habitat occurring on private land may require restoration to re-establish adequate conditions. Expand current efforts to work with landowners to identify opportunities for restoration and provide increased technical assistance; use existing Federal, State, and Tribal cost-share programs and Farm Bill programs such as the Conservation Reserve Program and Wetland Reserve Program to implement actions.

1.3. Water Quality

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.2. Fisheries Management

2.3. Small Population Size

2.4. Forage Fish Availability

3. Actions to Address Nonnative Fishes

3.1 Nonnative Fishes

3.1.1 Reduce brook trout competition with bull trout where they are known to coexist. Remove brook trout (*e.g.*, through liberalized angling, electrofishing, or other experimental techniques) in areas where there is a threat (competition, predation, hybridization) to bull trout local populations or other priority streams. Priorities include upper Crooked River.

4. Research, Monitoring and Evaluation

4.1 Habitat

4.2 Demographic

4.2.1 Determine the abundance of fluvial and resident bull trout and habitat used in the South Fork Clearwater River Core Areas. Continue implementation of existing bull trout population abundance and distribution studies, and initiate new studies. Identify and map the extent of habitat utilized by each local population. For fluvial bull trout, continue to determine spawning and wintering habitat and migratory pathways.

4.3 Nonnatives

Conservation Recommendations – includes North Fork Clearwater, South Fork Clearwater, Lochsa River, and Selway River core areas, and Clearwater River mainstem FMO within the Clearwater River basin.

- Conduct presence/absence surveys in previously uninventoried areas. Areas within Clearwater River core areas, especially wilderness areas, have not yet been fully inventoried. Utilize survey protocols that can assign confidence limits to survey results. Balance the need to have statistically significant survey results with the difficulty of accessing remote areas for the surveys. Priority areas include the Selway-Bitterroot and Gospel Hump wilderness areas and priority areas designated by local biologists.

- Determine the abundance of fluvial, adfluvial, and resident bull trout and habitat used in the Clearwater River Core Areas. Continue implementation of existing bull trout population abundance and distribution studies, and initiate new studies. Identify and map the extent of habitat utilized by each local population. For fluvial bull trout, continue to determine spawning and wintering habitat and migratory pathways.

- Monitor brook trout expansion. Monitor fish species distribution and trends in areas where the two species do not currently coexist and where the threat from brook trout appears trout represent. Known areas include Newsome Creek, and upper Crooked River where low numbers of brook trout have been found in the lower ends of the mainstems. Other areas include Orogrande Creek in the North Fork Clearwater core area; and dependent upon wilderness use/management constraints, Three Links, Gedney, Rhoda, Meadow, Mink, Buck Lake, Pettibone, and Running Creeks in the Selway- Bitterroot Wilderness.

- Evaluate extent of hybridization between bull and brook trout in areas where brook trout are firmly established and eradication is not possible. In areas where brook trout are firmly established and there is little opportunity to reduce the threat to bull trout, the priority should be genetic evaluation of the extent of hybridization that has occurred, along with continued trend analysis of the distribution and populations of both species. Priority areas are Red and American Rivers (South Fork Clearwater River core area); and East Moose Creek in the Selway core area.

- Ensure restrictions on suction dredge mining in bull trout habitat are effective. Evaluate compliance with and effectiveness of restrictions in protecting bull trout habitat and modify to improve effectiveness as necessary. Priority areas include Moose and Chamberlain Creeks, and other active suction dredge permits that overlap occupied bull trout habitat in the North Fork and South Fork Clearwater core areas.

- Ensure current mining regulations are effective. Evaluate compliance with and effectiveness of regulations in protecting bull trout habitat and modify to improve effectiveness as necessary. Priority areas include occupied bull trout habitat in the South Fork and North Fork Clearwater core areas.

- Evaluate direct losses of bull trout through Dworshak Dam. Drawdowns of Dworshak Reservoir can entrain bull trout and carry them into the mainstem Clearwater. In addition to causing a direct loss of individuals (and their genetic material) from local populations in the North Fork Clearwater River core area, these fish probably have low survival after entrainment. The loss of individuals from the upriver core area should be quantified and then evaluated in terms of its significance to long-term sustainability of the affected local populations.

- Evaluate the amount and relative threat of illegal bull trout harvest and incidental fishing mortality. Information on the current threat of illegal harvest and fishing mortality on bull trout is very limited. An evaluation of these threats should be completed to determine their significance to bull trout recovery and potential management opportunities to minimize their impacts. The level of threat should be evaluated within an overall Clearwater River Recovery Unit context, and also evaluated with respect to other mortality threats for each local population (or logical combinations of local populations). Focus areas should include: Fish Lakes (North Fork and Lochsa core areas); Selway River below Meadow Creek and near Moose and Shearer airstrips; Red and Crooked Rivers; North Fork Clearwater River below Dworshak Dam; upper North Fork Clearwater River in Black Canyon and above Long Creek; and Crooked Fork and Colt Killed Creeks and upper Lochsa River. This evaluation should consider the need for additional public awareness and outreach, which should be implemented wherever access to public lands is restricted.

- Evaluate the potential for release of excess hatchery stock of anadromous fish into occupied bull trout habitat. Evaluate the positive and potential negative impacts of anadromous fish stocking programs currently operating in the Clearwater River Recovery Unit. The Lochsa, Selway and Middle Fork of the Clearwater Rivers historically sustained much larger populations of anadromous fish, which supported larger populations of bull trout. Release of excess hatchery stock in areas where bull trout and anadromous fish historically coexisted, and where anadromous populations are currently depressed, may aid bull trout recovery. Such streams include Crooked Fork and Colt Killed Creeks, and the Lochsa, Selway, and South Fork Clearwater Rivers. Review annual fish stocking programs to assure those programs for anadromous fish are not contributing fish diseases, exotic invertebrates or other problems such as increased competition, which could interfere with bull trout recovery.

- Evaluate the need for reestablishing genetic connectivity between the North Fork Clearwater River and the remainder of the recovery unit. Based on research determinations of the degree of genetic isolation between the North Fork Clearwater and the Lochsa, Selway and South Fork Clearwater bull trout local populations and related management recommendations, evaluate the need for re-establishing the connection between these subbasins. If connection is needed, investigate fish passage opportunities downstream and upstream over Dworshak Dam.

- Conduct a genetic inventory. Collect samples for genetic analysis to contribute to understand the genetic baseline and monitor genetic changes throughout the range of bull. Collect genetic samples from known local populations, with priority given to populations where hybridization with brook trout presents a threat. Evaluate genetic diversity and the extent of hybridization. This information will be valuable for the conservation of the species across its range, and if local populations are extirpated within the Clearwater River core areas, this research may indicate what population may be best for future reintroduction efforts.

- Reduce fine sediment production. Identify and reduce fine sediment sources from agriculture and forest management practices. Stabilize roads, road stream crossings, landslides and other known sources of sediment delivery. Implement recommendations from the U.S. Forest Service and Bureau of Land Management Watershed Analyses and other plans that are geared to remediation of sediment production. Implement Best Management Practices in timber sale planning to minimize sediment production associated with logging activities. Priority watersheds include those with known or potential bull trout populations. In the North Fork Clearwater and Lochsa River basins, several watersheds have been intensively managed for timber production and are subject to elevated sedimentation from the activities and resulting landslides (*e.g.*, Quartz, Cold Springs, Deception, Breakfast, and Fishing Creek watersheds). Roads constructed for logging and mining are a constant source of sediment in the Fishing, Legendary Bear, Shotgun, Spruce, Beaver, and lower Boulder Creek watersheds. Highway 12 is a source of gravel and fine sediments to the Lochsa River, Crooked Fork Creek, Middle Fork Clearwater River, and the Clearwater River.

- <u>Address forest road maintenance and areas with high sediment loading</u>. Improve roads that negatively impact water quality by removal, access restrictions, making alternative routes, and/or upgrading roads and applying all maintenance procedures. Emphasize maintenance of extensive U.S. Forest Service and State lands secondary road systems by increased application of Best Management Practices, with a focus on remediation of sediment producing hotspots, and maintenance of bridges, culverts, and crossings in drainages supporting bull trout spawning and rearing. Decommission/remove surplus forest roads: especially those that are chronic sources of fine sediment and/or those located in areas of highly erodible geological formations. Remove culverts and/or bridges on closed roads that are no longer maintained.

- <u>Improve maintenance along transportation corridors</u>. The maintenance of all major roads along riparian corridors should be improved to reduce impacts of fine sediment and floodplain encroachment. Whenever possible, relocate problem (high sediment-producing) road reaches out of riparian corridors. Locate all dump areas for excess road material in stable upland areas away from stream/riverbeds. Priority areas include the Highway 12 corridor along Crooked Fork Creek and the Lochsa River; the Middle Fork and Clearwater Rivers and their major tributaries; the Camas Prairie railroad along the Clearwater River; U.S. Forest Service Roads 247 and 250 from the upper part of Dworshak reservoir to the Cedars campground near the mouths of Long and Lake Creeks, and Road 250 from Long Creek to Hoodoo pass on the Montana border.

- <u>Restore areas degraded by historical timber harvest</u>. Legacy impacts from timber harvest include lack of riparian trees and vegetation, high road densities, large areas of clearcuts, altered hydrologic regimes including increased peak flows, and other impacts that have created excessive fine sediment sources for watersheds. Potential restoration treatments include channel stabilization, riparian and upland plantings, placement of instream woody debris, etc. The following drainages have been degraded by historic timber harvest and have embedded and de-stabilized streams: Quartz, Cold Springs, Skull, Deception, Beaver, Isabella, and Moose Creeks within the North Fork Clearwater; and Fishing, Legendary Bear, Shotgun, Spruce, Beaver, and lower Boulder Creeks within the Lochsa. Streams in the upper Little North Fork Clearwater River include Adair, Jungle, Rutledge, and Montana Creeks, where historic management has removed streamside vegetation and increased fine sediment delivery.

- Revegetate degraded riparian areas. Develop site specific plans to promote revegetation of riparian areas to ensure sufficient shade and canopy, large woody debris recruitment, riparian cover, and native vegetation are present to support native salmonids. Highest priority is on streams with existing bull trout populations. Revegetate riparian areas affected by logging in: Kelly Creek drainage, particularly in the Moose Creek and Cayuse Creek watersheds within the North Fork Clearwater. Restore riparian vegetation removed by fire and timber salvage along the lower 3.2 km (2 miles) of West Fork Floodwood Creek. Restore riparian vegetation removed by fires in: Hidden, Isabella, Skull, Quartz Creeks within the North Fork Clearwater; and Haskell and Crooked Fork Creeks in the Lochsa.

- Implement restoration actions in areas in which secondary roads have been constructed in the floodplain. These roads have displaced riparian vegetation and are a constant source of fine sediment to the streams. Appropriate remedial measures should be developed and implemented. Priority areas include those in occupied bull trout habitat: Fishing, Legendary Bear, North Fork Spruce and Shoot Creeks within the Lochsa; and Kelly, Cayuse, and upper North Fork Clearwater River in the North Fork Clearwater.

- Compensate for legacy timber harvest and associated roading practices. Continue to mitigate for the legacy of intensive timber harvest and poor silvicultural and road construction practices in steep and highly erosive canyon breaklands. Past practices and road systems have resulted in mass wasting events and continued erosion and sediment introduction into bull trout habitat. Actions including: replanting, obliterating roads, and improving road maintenance should be continued and new techniques implemented. Priority areas include the upper Lochsa River checkerboard ownership areas; and Lake, Moose, Osier, Quartz, Skull, Orogrande, Sheep Mountain, Beaver Block, Floodwood, and Breakfast Creek drainages in the North Fork Clearwater.

- Integrate watershed restoration efforts on public and private lands. Integrate watershed analyses and restoration activities on public lands in the headwaters and private lands, which occur primarily lower in the watershed, to ensure that activities maximize benefits and are complementary to bull trout restoration.

- Identify problem mine sites and remediate tailings, ponds, and other associated waste. Control mining runoff from roads, dumps, and ponds, and remove and stabilize mine tailings and waste rock deposited in the stream channel and floodplains and restore stream channel function. In the North Fork Clearwater, Moose, Independence, and Chamberlain Creek watersheds are a high priority, followed by Vanderbilt, Niagra and Meadow Creek watersheds.

- Restore stream reaches degraded by dredge and placer mining. Restore habitat, as feasible, in stream reaches that have been channelized and affected by mine tailing piles in the Moose Creek watershed of the North Fork Clearwater.

- Improve instream habitat. Conduct stream restoration in areas impacted by legacy and ongoing road effects, logging, agriculture, grazing, and urban development, stream cleaning, and mining. Increase or improve instream habitat by restoring recruitment of large woody debris, pools, or other appropriate habitat, wherever the need is identified. Priority watersheds include the upper North Fork Clearwater River, including Meadow, Caledonia, Vanderbilt, and Niagara Creeks; and the upper Lochsa River drainage, including North Fork Spruce, Shoot, Twin, Legendary Bear, and Fishing Creeks.

- Implement actions to restore areas of Fish Lake Creek (Lochsa River) degraded by channelization and excessive bank erosion associated with the Fish Lake airstrip and campsites. Restore over-used campsites, reduce erosion on exposed banks, restrict pack animals from the stream, and construct trail bridges at two popular crossings (one at the trailhead). Evaluate the potential of restoring a natural meander pattern in the channelized reach of the inlet stream, either on the airstrip (where it was originally), or in the meadow complex to the southeast of the airstrip.

- Improve stream channels near transportation corridors. Improve stream conditions where current and legacy highway and railroad encroachment, channel straightening, channel relocation, and undersized bridges exist. Initial areas to focus efforts include: the Lochsa River Highway 12 corridor, Middle Fork/Lower Clearwater River railroad, and Highway 12 corridors. Highway 12 has reduced large wood recruitment and access to off-channel habitat in the Lochsa River, Crooked Fork Creek, and Middle Fork Clearwater River.

- Implement restoration of overwintering habitat in the mainstem rivers. Implement necessary restoration activities to improve overwintering habitat in the Middle Fork and Clearwater Rivers.

- Provide long-term protection of perennial stream reaches. Work cooperatively with private landowners and the Natural Resource Conservation Service to provide voluntary incentives for long-term habitat protection. Some habitat important for bull trout recovery, especially migratory, foraging, and overwintering habitat occur on private lands and may need protection to maintain conditions conducive to bull trout recovery. A variety of cooperative arrangements could be made with landowners to protect and restore habitat on their land. Where possible combine efforts for bull trout with anadromous fish recovery efforts. Initial emphasis should be placed on identified bull trout spawning and rearing streams. Priority areas include Brushy Fork, Spruce, Twin, Crooked Fork, Legendary Bear, and Colt Killed Creeks in the Lochsa; and Floodwood and Beaver Creeks in the North Fork Clearwater.

- Identify opportunities for habitat restoration and provide assistance to landowners. Some important bull trout habitat occurring on private land may require restoration to re-establish adequate conditions. Expand current efforts to work with landowners to identify opportunities for restoration and provide increased technical assistance; use existing Federal, State, and Tribal cost-share programs and Farm Bill programs such as the Conservation Reserve Program and Wetland Reserve Program to implement actions.

- Mitigate point and nonpoint thermal pollution. Remove effects to bull trout from thermal pollution that negatively impacts receiving waters and migratory corridors downstream. Priority watersheds include: South Fork Clearwater River mainstem and tributaries; Osier Creek and tributaries to Dworshak Reservoir; Lochsa River mainstem and tributaries; major tributaries to the mainstem Clearwater River and their tributaries; as well as Potlatch River, Lapwai Creek, Lolo Creek, and Big Canyon Creek.

- Eliminate or reduce the number and length of stream segments with impaired water quality. Eliminate or modify factors responsible for stream reaches listed as "water quality limited segments" under section 303(d) of the Clean Water Act. Prioritize streams within identified bull trout local populations and streams identified as providing foraging, migrating, and overwintering habitat.

- Eliminate known culvert and other man-made passage barriers. Replace, modify, or remove existing culverts, bridges, or other man-made barriers that impede passage. Consider native fish genetic concerns and the potential for invasion by nonnatives in all such evaluations. New culverts should be constructed to avoid inhibiting passage of all life history phases of fish. New appropriately designed culverts or bridges are recommended at stream crossings in habitat used by all life stages of bull trout. Monitor all projects after completion to determine if fish passage is restored. The highest priority for eliminating passage barriers and re-establishing connectivity is the South Fork River core area, followed by the Lochsa and North Fork Clearwater.

- Continue public outreach about fishing regulations, bull trout identification, and proper handling/release techniques. Maintain signs that are currently posted on Federal and State land throughout the recovery unit. Display posters annually, especially at angling access areas and backcountry portals such as trailheads. Sign boards and posters should be displayed at backcountry airstrips at Fish Lake (Lochsa River); Moose Creek and Shearer (Selway River core area). Produce educational materials (pamphlets, wallet cards, etc.) for anglers addressing bull trout identification, proper handling and release techniques to reduce hooking mortality, regulations, and reasons for protective regulations. Distribute materials using U.S. Forest Service, Idaho Department of Fish and Game, and Bureau of Land Management personnel and offices; local businesses; and tourism centers.

- <u>Decrease incidental mortality of bull trout due to angling</u>. Conduct additional patrols in sensitive areas at critical times. Consider regulation changes such as tributary closures to protect bull trout. Patrols should focus on identified staging (June to August), spawning (September to October), and wintering (November to March) areas for bull trout. Staging areas include larger mainstem streams below headwater tributaries, such as Black Canyon of the North Fork Clearwater River. Wintering areas include large mainstem rivers at lower elevations, such as the Middle Fork and lower Clearwater Rivers. For example, incidental mortality of wintering fluvial bull trout may be occurring during the winter and spring steelhead/salmon seasons in the Clearwater River.

- <u>Continue enforcement activities relating to regulations prohibiting bull trout harvest.</u> Specifically target known or identified problem areas where unauthorized harvest of bull trout is occurring. Continue backcountry enforcement patrols in the Selway-Bitterroot Wilderness around human concentration areas and near spawning and rearing areas. Continue enforcement patrols at the two Fish Lakes. Continue enforcement along mainstem rivers paralleled by roads, especially in areas with late winter and spring steelhead and salmon fishing seasons. Also target known problem areas on the lower Selway, upper North Fork Clearwater, and upper Lochsa Rivers.

- <u>Operate Dworshak Dam to reduce losses of kokanee salmon</u>. Substantial numbers of kokanee, which have been introduced into Dworshak Reservoir and are a forage fish for bull trout, can be entrained below the dam during spills. Methods to reduce kokanee losses should be evaluated and implemented.

- <u>Reduce brook trout competition with bull trout where they are known to coexist</u>. Remove brook trout (*e.g.*, through liberalized angling, electrofishing, or other experimental techniques) in areas where there is a threat (competition, predation, hybridization) to bull trout local populations or other priority streams. Priorities include Adair and Jungle Creeks in the upper Little North Fork Clearwater River, Elizabeth, Isabella, Larson, and Beaver Creeks, and the Meadow Creek drainage and associated high mountain lakes in the North Fork Clearwater; and Colt Killed Creek and its tributaries, Fish Lake Creek, Bimerick, Deadman, Stanley, Boulder, and Old Man Creeks in the Lochsa River.

Note: the above actions were derived (and modified) from the 2002 Bull Trout Draft Recovery Plan, Chapter 16, Clearwater River.

Tucannon River Core Area

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

Urban Development and Agricultural Practices

1.1.1 Protect and, where needed, revegetate riparian zones in areas used by bull trout. Consider incentives to encourage landowners and land management agencies to improve riparian conditions.

1.1.2 Implement measures identified in the Snake River Salmon Recovery Plan. Complete actions identified to improve riparian vegetation, floodplain connectivity, channel complexity and other limiting factors identified in the salmon recovery plan within bull trout FMO and SR habitat.

1.2 Instream Impacts

Flood Control

1.2.1 Incorporate non-intrusive flood repair activities into proactive policy. Much of the streambank along urbanized sections of the Tucannon River has been channelized, ditched, armored, or riprapped to protect roads and infrastructure and provide flood control. Provide technical assistance to Columbia County and private landowners on options for fish-friendly flood repair techniques that will help to improve or restore channel processes that benefit bull trout or their habitat. Develop a policy for local landowners during flood emergencies to minimize impacts to bull trout habitat both during the flood and after flood repairs.

1.2.2 Reduce, prevent, and minimize development in floodplains. Work with City and County agencies to reduce or eliminate development of floodplain areas for any purpose except to dissipate flood water and energy or to perform restoration activities. Where possible, restore floodplain connectivity, remove or set-back levees, and increase off channel areas.

1.2.3 Investigate land acquisition from willing sellers as an opportunity to protect bull trout. Where appropriate, pursue land purchases, easements, and agreements in the Tucannon River Core Area along within bull trout spawning, rearing, and FMO habitat. Pursue land exchanges with agencies and nongovernmental organizations to protect bull trout areas from future urban development and initiate activities to restore riparian and floodplain function when appropriate to protect bull trout habitat.

Dewatering

1.2.4 Evaluate the need to install additional permanent stream gauging stations. Determine whether permanent stream gauging stations would aid enforcement of permitted irrigation diversion volumes and surface water rights in the upper Tucannon River and Pataha Creek. If such stations would aid enforcement, install gauges and monitor stream flows. Keep and maintain existing gages.

1.2.5 Implement recommendations in the Tucannon River Geomorphic Assessment and Habitat Restoration Study (Anchor 2011). Build on and complete conceptual designs for all recommended reaches for improving wood recruitment, habitat complexity, bank stabilization, riparian plantings, and floodplain connectivity. Identify funding sources and implement actions as possible.

1.2.6 Identify and restore aggrading stream channels to restore flow, reduce subsurface flows, and increase channel stability. Conduct stream surveys to identify or better define problems and possible solutions to restore stream channel stability, function, complexity, and bedload sources that lead to reduced surface flow and increased subsurface flow at the confluence of streams. Use this information to guide restoration activities in the Tucannon River Core Area, especially Little Tucannon River, Charley, Cummings, Pataha, and Tumalum Creeks.

Transportation and Utility Networks

1.2.7 Assess and mitigate roads that are floodplain confining. Based on assessment, relocate roads out of the floodplain or stabilize them. Where roads cannot be relocated; recontour road fill slopes and seed with native vegetation to prevent slumping. Add adequate surface material, if needed, to prevent sediment movement. Examples include Camp Wooten gravel road and Panjab Forks Road.

1.2.8 Protect riparian and channel habitat at managed and unmanaged campgrounds, trail systems, and recreation sites. Develop riparian and stream channel management plans to protect migration, spawning, and rearing habitat adjacent to trail systems, camping sites, and recreation sites. Relocate campgrounds out of riparian areas when necessary to avoid impacts to bull trout habitat. Restore and protect riparian and channel habitat along heavily used trails and trailheads.

1.3 Water Quality

Water Quality Impairment

1.3.1 Reduce stream temperatures by enhancing riparian area and correcting floodplain connectivity. Restore riparian vegetation buffers and widen the floodplain via levee setbacks or removal to help reduce summer temperatures on the mainstem Tucannon River from Marengo downstream, especially in the Wooten Wildlife Area, and in Pataha Creek from Columbia Center downstream to the confluence with the Tucannon River.

1.3.2 Assess water quality and remedy impacts from individual residences and communities (Bilhimer *et al*. 2010). Investigate the extent of water quality problems at the towns of Starbuck, Marengo, and Pomeroy and at the concentrated rural development along the lower 25 km (16 miles) of the mainstem in the Tucannon River Basin.

Transportation Networks

1.3.3 Identify unstable and problem roads causing fine sediment delivery. Identify sources of fine sediment input from historical road networks on Federal and State lands within bull trout critical habitat areas. Reduce and prevent erosion from identified problem locations on motorized access roads and from closed roads at trailheads.

Recreation

1.3.4 Protect riparian and channel habitat at managed and unmanaged campgrounds, trail systems, and recreation sites. Develop riparian and stream channel management plans to protect migration, spawning, and rearing habitat adjacent to trail systems, camping sites, and recreation sites. Relocate campgrounds out of riparian areas when necessary to avoid impacts to bull trout habitat. Restore and protect riparian and channel habitat along heavily used trails and trailheads.

1.3.5 Reduce sediment inputs from recreational-based channel damage. Assess damaged areas and reduce sediment input from riparian and streambank alterations caused by motorized and non-motorized use of access trails along the Tucannon River. Work with the managers of State and Federally owned campgrounds to relocate campgrounds out of the riparian zone and floodplain to prevent further damage to vegetation and streambanks, if effective controls are not implemented.

Agriculture Practices

1.3.6 Complete recommendations generated from sediment monitoring and abatement plans. Review and coordinate sediment abatement actions in response to sediment monitoring in throughout the Tucannon Core Area. Promote agricultural practices such as no-till drill seeding to reduce sediment delivery to streams identified for bull trout recovery.

1.3.7 Develop and implement comprehensive livestock grazing management plans. Develop, implement, and revise, when necessary, adaptive livestock grazing management plans. Work with landowners, managers, and agriculture agencies to fence around streams and riparian areas and build off-site watering facilities. Include mid-season performance standards that maintain stream channel conditions for quality bull trout spawning and rearing habitat.

2. Actions to Address Demographic Threats

2.1 Connectivity Impairment

Entrainment & Fish Passage Issues

2.1.1 Remove permanent and seasonal barriers to bull trout migration. Identify complete, partial, or seasonal barriers caused by debris jams, rock barriers, irrigation wing dams, culvert drops, bridge crossings, or other manmade structures that hinder or prevent bull trout from accessing upstream spawning or rearing habitat. Remove or modify Starbuck Dam, if necessary, and other potential barriers on private land, to allow free unimpeded movement of bull trout both upstream and downstream during all flow conditions.

2.1.2 Modify operation and timing of Tucannon Hatchery Adult trap to reduce impacts to bull trout migration. Current operation of the Tucannon Hatchery weir causes bull trout migration delays and mortality. Modify operations to reduce impacts to bull trout.

2.1.3 Assess and remove barriers to movement between local populations. Work with property owners to correct partial and permanent barriers on private property. Investigate the feasibility of installing appropriately designed crossings or culverts to improve channel function and fish passage and make modifications where feasible.

2.1.4 Review existing bull trout information and determine limiting factors affecting bull trout at Ice Harbor, Lower Monumental, Little Goose, and Lower Granite Dams. Analyze existing biological information and determine whether there are limiting factors causing take of bull trout that have not already been addressed through dam operations for salmon and steelhead.

2.1.5 Identify and determine impacts of Snake River Dam operations on habitats for foraging, migrating, and overwintering. Determine research needs associated with the operation of Ice Harbor, Lower Monumental, Little Goose, and Lower Granite Dams and use of the reservoirs by bull trout. Collect movement data for all seasons and during periods when mainstem ladders are not operational to determine effects to migration and foraging from operation of the dams. Using data collected on habitat use and effects to migration to develop restoration actions and modify ladder or dam operations to benefit bull trout movement in the Snake River. Determine impacts of Snake River Dam operations on forage species and effects that losses of forage have on migrating bull trout.

2.2 Fisheries Management

2.3 Small Population Size

2.4 Forage Fish Availability

3. Actions to Address Nonnative Fishes

3.1 Nonnative Fishes

Introduced Species/Fisheries Management

3.1.1 Evaluate potential impacts of hatchery rainbow trout. Review and address potential impacts from continuing rainbow trout stocking programs in Spring, Blue, Rainbow, Deer, Watson, Beaver, Big Four, and Curl Lakes. Review the effectiveness of existing policies for public and private fish stocking for minimizing impacts on bull trout. Consider discontinuing program if effects to bull trout are determined. Take action based on the results to reduce the risks to bull trout of unwanted fish introductions.

Hybridization/Competition

3.1.2 Determine distribution, abundance, and impact of brook trout on bull trout populations. Brook trout are believed to be partially responsible for extirpation of bull trout in Pataha Creek. Conduct fish surveys to determine the distribution and abundance of brook trout in Pataha Creek and the mainstem of the Tucannon River upstream from the mouth of Pataha Creek. Map brook trout distribution and calculate relative abundance to aid in the feasibility analysis for removing brook trout from Pataha Creek.

3.1.3 Perform feasibility analysis to remove/suppress brook trout in Pataha Creek. Study the physical and economic potential for experimental removal or suppression of brook trout from Pataha Creek. Develop recommendations for methodologies and time frames.

3.1.4 Encourage brook trout harvest in Pataha Creek. Remove harvest limits for brook trout to encourage harvest of the fish in Pataha Creek. Provide education signage and information to public on fish identification between brook trout and bull trout to reduce potential for illegal harvest. Implement management strategies to ensure that brook trout populations do not expand into the Tucannon River from Pataha Creek.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.1.1 Monitor the effectiveness of implemented restoration actions in benefitting bull trout and bull trout habitat. Monitor the effectiveness of habitat or floodplain restoration actions to determine if the designed function has been met and if bull trout have responded to the action as predicted. Apply adaptive management principles to modify future projects so that implemented projects meet recovery goals and intentions for bull trout.

4.2 Demographic

4.2.1 Continue ongoing population and genetic monitoring efforts within the basin. Maintain current long term datasets assessing abundance, distribution, and genetic diversity of bull trout in the basin. Continue to coordinate surveys among partner agencies.

4.2.2 Continue maintenance and operation of fish screens on all diversions. To prevent entrainment consistent monitoring and maintenance is necessary to keep fish screens operating properly.

4.2.3 Conduct presence and absence surveys to fully describe the distribution of juvenile, subadult, and adult bull trout. Conduct standardized, intensive, and statistically sound electrofishing and/or snorkeling surveys in the upper mainstem of the Tucannon River from Tumalum Creek to Bear Creek and in tributaries including the Little Tucannon River and Cummings, Cold, Sheep, Bear, Panjab, Meadow, Turkey, Little Turkey, Hixon, and upper Pataha Creeks. Include atypical areas such as Russell Springs Creek and Hartsock Springs. Repeat surveys every five to six years to facilitate assessment of effectiveness of recovery efforts through time and evaluate progress towards recovery goals. Utilize developing tools, such as environmental DNA, to identify new bull trout areas.

Asotin Creek Core Area

1. Actions to Address Habitat Threats

1.1 Upland/Riparian Land Management

Forest Management and Transportation Networks

1.1.1 Identify unstable and problem roads causing fine sediment delivery. Survey and identify sediment delivery from County roads associated with the Asotin Creek Road. Evaluate roads to identify sediment sources and sediment delivery points during rainstorms and spring runoff. Survey all bridges, culverts, fill slopes, and unstable road sections in areas of known local populations and potential local populations in Asotin Creek. Identify all head-cuts and incidences of mass wasting that may negatively impact riparian areas and inhibit natural stream functions.

1.1.2 Move roads that are in riparian areas out of the floodplain or stabilize the roads. Where possible, move roads out of floodplains along streams that have known local populations of bull trout or streams that have been identified as essential for reestablishing local populations of bull trout. Where roads cannot be moved, stabilize them: recontour road fill slopes and seed with native vegetation to prevent slumping. Add adequate surface material, if needed, to prevent sediment movement.

1.1.3 Find and eliminate fine sediment sources from historical roads. Identify sources of fine sediment input from historical road networks on Federal and State lands that are managed as part of the Federal Umatilla National Forest or the State- owned Asotin Creek Wildlife Area. Reduce and prevent erosion from identified problem locations on motorized access roads and from closed roads at trailheads.

1.1.4 Improve routine road maintenance practices. Road maintenance practices have been identified as adversely affecting bull trout habitat where maintenance occurs on roads next to streams. Change or improve road maintenance protocols on all Federal-, State-, and County- managed roads throughout Asotin Creek Core Area to minimize erosion and riparian damage. Upslope road ditches should be directed to downslope areas away from stream channels and so be prevented from discharging into streams.

Residential and Urban Development

1.1.5 Investigate land acquisition from willing sellers as an opportunity to protect bull trout. Where appropriate, pursue land purchases, easements, and agreements in Asotin Creek along stream corridors that contain sensitive bull trout spawning, migrating, and rearing habitat. Pursue land exchanges with agencies and nongovernmental organizations to protect bull trout areas from future urban development and initiate activities to restore riparian and channel function when appropriate to protect bull trout habitat.

1.1.6 Minimize further development in floodplains. Work with City and County agencies to rezone riparian areas or to develop a riparian area protection policy. Reduce or eliminate development of floodplain areas in Asotin Creek for any purpose except to dissipate flood water and energy or to perform restoration activities. Where possible, restore floodplain connectivity. Work with private and public landowners to maintain, protect and enhance pristine and other areas of the headwaters by encouraging application of riparian and instream BMPs.

1.1.7 Assess water quality and remedy impacts from individual residences and communities. Investigate the effects and relative threats to bull trout from septic tank leakage, waste water drainage, and other potential water quality problems originating from the City of Asotin and from the rural residential development concentrated in the lower 8 km (5 miles) of Asotin Creek. Recommendations should be made on actions to remedy water quality impacts.

Recreation

1.1.8 Reduce sediment inputs from recreational-based channel damage. Assess damaged areas and reduce sediment input from riparian and streambank alterations caused by motorized and nonmotorized use of access trails. Work with the managers of State and Federally owned campgrounds to relocate campgrounds out of the riparian zone and floodplain to prevent further damage to vegetation and streambanks if effective controls are not implemented.

1.1.9 Develop and install educational watershed protection signs in riparian areas of State and Federal campgrounds. In the Asotin Creek watershed, develop riparian protection signs in sensitive streamside areas on State and Federal lands.

1.1.10 Protect riparian and channel habitat at unmanaged/dispersed campsites, trail systems, and recreation sites. Develop riparian and stream channel management plans to protect migration, spawning, and rearing habitat adjacent to trail systems, camping sites, and recreation sites. Restore and protect riparian and channel habitat along heavily used trails and trailheads.

Agriculture Practices

1.1.11 <u>Conduct a complete inventory of surface water diversions</u>. Inventory all surface water diversions in Asotin Creek Core Areas. Evaluate compliance with State, U.S. Fish and Wildlife Service, and the National Marine Fisheries Service screening criteria. Screen all diversions to meet State and Federal requirements.

1.1.12 <u>Maintain and review comprehensive livestock grazing management plans</u>. Maintain, implement, and revise, when necessary, adaptive livestock grazing management plans. Include mid-season performance standards that maintain stream channel and riparian conditions for quality bull trout spawning and rearing habitat.

1.1.13 <u>Identify and restore riparian vegetation in priority streams.</u> Identify sites and revegetate to restore shade and canopy, riparian cover, and native vegetation to improve or maintain bull trout habitat. Reduce summer stream temperatures by restoring riparian buffers in the mainstem of Asotin Creek, lower Charley Creek, George Creek, and South Fork Asotin Creek.

1.1.14 <u>Reduce fine sediment inputs from agricultural land</u>. Identify sources and work with landowners and agriculture agencies to reduce fine sediment inputs to Asotin Creek. Identify and reduce sediment sources to George, Pintler, Charley, and Lick Creeks.

1.1.15 <u>Reduce impacts of livestock on streams and riparian areas</u>. To reduce impacts from livestock, work with landowners, managers, and agriculture agencies to fence around streams and riparian areas in both core areas. Develop off-site livestock watering facilities.

1.1.16 <u>Review and act on recommendations generated from sediment budget and LiDAR assessments</u>. Coordinate and review progress with landowners and land managers on Natural Resources Conservation Service sediment monitoring and abatement plans in the Asotin Creek watershed, especially Charley Creek, North Fork Asotin Creek, South Fork Asotin Creek, George Creek, and the mainstem of Asotin Creek. Promote agricultural practices such as no-till seeding to reduce sediment delivery to streams identified for bull trout recovery.

1.1.17 <u>Stabilize streambeds and banks.</u> In Charley Creek, permanently repair active head-cut damage and revegetate the stream channel where mass wasting problems are associated with failure of two fishing ponds constructed in the stream channel. Head-cuts have enlarged this area, and excessive sediment is delivered to the lower reaches of Charley Creek and Asotin Creek. Repair streambanks in the Asotin Creek on State and

National Forest lands where streamside grazing occurs and where past timber harvest occurred with no stream buffer. Develop additional private landowner cooperation to restore streambanks, stream function, and floodplain connectivity on private grazing and agricultural lands along stream corridors.

1.2 Instream Impacts

Flood Control

1.2.1 Incorporate non-intrusive flood repair activities. Provide technical assistance to Asotin County and private landowners on options for fish-friendly flood repair techniques that will help to improve or restore channel processes that benefit bull trout or their habitat.

1.2.2 Promote programs to restore and protect floodplain and channel function. Identify, promote, and continue incentives through the Asotin County Conservation Districts to promote programs centered on restoring floodplain and channel function in the mainstem of Asotin Creek below Headgate Dam.

Dewatering

1.2.3 Restore stream channels to appropriate channel type. In the Asotin Creek Core Area, address intermittent stream problems in the lower 0.8 km (0.5 mile) in George Creek and restore and maintain a functional, single-thread channel on lower George Creek from river km 2.8 to 5.8 (river mile 1.6 to 3.6) and river km 7.2 to 9.2 (river mile 4.5 to 5.7) by reconstructing meanders and restoring floodplains and riparian zones that contain trees and other sources for recruitment of large woody debris.

1.2.4 Evaluate the need to install and maintain permanent stream gauging stations. Determine whether permanent stream gauging stations would aid enforcement of permitted irrigation diversion volumes and surface water rights in Asotin Creek. If such stations would aid enforcement, install gauges and monitor stream flows.

1.2.5 Identify sources and locations of groundwater infiltration to streams. In bull trout local populations and potential local populations in the Asotin Creek Core Area, survey, locate, and map areas where groundwater percolates through the streambed and contributes to bull trout habitat. Use this information to correlate bull trout distribution with groundwater inflow and estimate the amount of bull trout habitat available in occupied and unoccupied streams.

1.2.6 Identify factors contributing to elevated stream temperatures. Implement water temperature monitoring on State and Federal lands. Identify and correct reasons for temperature exceedances in bull trout migratory and rearing habitat in Asotin Creek.

1.3 Water Quality

2. Actions to Address Demographic Threats

2.1 Connectivity Impairment

Entrainment & Fish Passage Issues

2.1.1 Remove permanent and seasonal barriers to bull trout migration. Identify complete, partial, or seasonal barriers caused by debris jams, irrigation wing dams, culvert drops, bridge crossings, or other manmade structures that hinder or prevent bull trout from accessing upstream spawning or rearing habitat and movement between areas of foraging and refugia. Survey all culverts and crossings at various flows in the mainstem of Asotin Creek, Charley Creek and George Creek.

2.1.2 Eliminate barriers to bull trout passage at remnant power and irrigation dams. Modify the remnant Headgate Dam structure and existing fish ladder in Asotin Creek, to allow free unimpeded movement of bull trout both upstream and downstream during all flow conditions.

2.1.3 Evaluate passage effectiveness after correction at Headgate Dam. Determine if proposed correction at Headgate Dam reduces or eliminates entrainment for migratory bull trout in Asotin Creek. Use PIT arrays or other methods to determine effectiveness. If determined ineffective for bull trout, correct or remove barrier.

2.1.4 Review existing bull trout information and determine limiting factors affecting bull trout at Snake River Dams. Analyze existing biological information and determine whether there are limiting factors causing take of bull trout that have not already been addressed through dam operations for salmon and steelhead. Utilize salmon sampling and collection procedures to also collect information on bull trout use, presence at, and impacts of the dams (especially Lower Granite Dam) on bull trout migrating out of Asotin Creek.

2.1.5 Identify study needs related to habitats for foraging, migrating, and overwintering in Snake River reservoirs. Determine research needs associated with the operation of Lower Monumental Dam, Little Goose, and Lower Granite Dams and with movement of bull trout from tributary streams into, and through, associated reservoirs. Conduct research on identified topics and then implement feasible remedies.

2.2 Fisheries Management

2.3 Small Population Size

2.3.1 Conduct watershed analyses to evaluate past, current, and future bull trout production potential. Conduct watershed analyses to describe the past, current, and future (restored) potential of mainstem reaches and tributary streams to support bull trout recovery. To aid in adaptive management of recovery goals, identify site-specific tasks for recovery actions appropriate for individual watersheds. Watershed analyses are intended to generate a holistic understanding of land use and stream conditions within a watershed. Analyses should identify likely historical conditions that can be used to develop restoration actions and to prioritize problems within a watershed. A complete watershed analysis should contain, at a minimum, assessments for roads, riparian areas, channel and flow characteristics, water temperatures, and habitat size. Relate watershed study plan to the needs of bull trout.

2.3.2 Investigate use of prescribed fire. Evaluate the use of prescribed fire to mimic natural disturbance to reinvigorate forested watersheds in both core areas. Review fire suppression efforts and emphasize continued fire suppression to reduce the risk of catastrophic fire, while not putting bull trout watersheds at risk. In Asotin Creek, evaluate methods to reduce the potential for wildfire in North Fork Asotin Creek and Cougar Creek to protect small local populations.

2.3.3 Build on current and recent PIT tagging of bull trout by WDFW and Utah State researchers. This effort would use the existing PIT tag arrays scattered throughout the mainstem Asotin and the North and South Forks and Charley Creek and the WDFW traps to monitor the movements of PIT tagged bull trout within the basin. Utilize data to understand movements and distribution and determine whether a migratory life history of bull trout persists in the Asotin Core Area, or whether migratory bull trout are solely utilizing lower Asotin Creek as FMO habitat.

2.4 Forage Fish Availability

3. Actions to Address Non-native Fishes

3.1 Non-native Fish

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.1.1 Evaluate condition and status of forage base throughout watershed. Determine if forage base conditions are limiting for bull trout in North Fork Asotin Creek and potential local population areas such as Charley, South Fork and George Creeks.

4.2 Demographic

4.2.1 Conduct genetic inventory. Collect samples for genetic analyses to contribute to establishing a program to understand genetic baseline and monitor genetic changes throughout the range of bull trout (see Chapter 1). Asotin Creek and the Tucannon River Core Areas are separated by the mainstem hydroelectric facilities at Little Goose and Lower Granite Dams. Although genetic analyses have not been initiated to provide conclusive evidence, interbreeding between these populations is very unlikely because of the physical distance separating these streams. Additional genetic information is needed to validate the separation of bull trout within the core areas of the Mid-Columbia Recovery Unit. Genetic work for Asotin Creek bull trout must include objectives to determine whether a viable population exists and whether inbreeding depression has become a factor that could hinder recovery efforts. Collect tissue samples in a non-lethal manner and complete genetic analyses on bull trout in North Fork Asotin Creek and Cougar Creek. This genetic work is needed to provide an understanding of the genetic structure of local populations in both core areas and to provide a baseline from which to monitor genetic similarities and differences between bull trout in adjacent recovery units. Evaluate and describe the genetic structure of bull trout in in Cougar Creek, North Fork Asotin Creek, and other potential local populations.

4.2.2 Conduct presence and absence surveys to fully describe the distribution of juvenile, subadult, and adult bull trout. Conduct standardized, intensive, and statistically sound electrofishing and/or snorkeling surveys in Asotin Creek. Design surveys to describe the full distribution and abundance of juvenile and subadult bull trout in Asotin Creek. Standardize and describe sampling methods and sampling locations to allow repeatability of surveys. Repeat surveys every five to six years to facilitate assessment of effectiveness of recovery efforts through time and evaluate progress towards recovery goals.

4.2.3 Determine whether the hydropower system on the lower Snake River is adversely affecting migratory bull trout from the Asotin Creek Core Area. Implement studies to determine habitat needs, use of, and impacts of connectivity loss for migratory form in Asotin Creek. Determine methods to improve conditions for migratory life history in the watershed.

4.3 Non-natives

4.3.1 Evaluate potential impacts of hatchery rainbow trout. Review and address potential impacts from rainbow trout stocking programs in Headgate Pond. Review the effectiveness of existing policies for public and private fish stocking for minimizing impacts on bull trout. Take action based on the results to reduce the risks to bull trout of unwanted fish introductions.

4.3.2 Evaluate impacts of non-native predatory species in mainstem Snake River. Assess and review what, if any impact, non-native predatory species in the mainstem Snake River have on migratory bull trout from Asotin Creek.

Conservation Recommendations

- Continue bull trout harvest closure in the Mid-Columbia Recovery Unit. Continue implementing and enforcing fishing closures for bull trout in Asotin Creek, at least until bull trout abundance and distribution have been fully determined, threats to production and population stability have been removed, and numbers of spawning adults show a definite increasing trend and have met recovery criteria.

- Summarize existing bull trout bycatch (incidental capture) data and implement angler interviews that target bull trout bycatch. Implement a standard creel survey protocol that specifically targets bull trout bycatch information during steelhead angler interviews in the fall, winter, and spring. Implement the same protocol for anglers seeking other species during the summer. Use this information to support distribution and abundance trends for bull trout in both core areas and provide this information to the recovery unit coordinator on an annual basis.

- Reduce incidental harvest by outreach to recreational anglers and increasing awareness of bull trout population status. Reduce unintentional harvest of bull trout and mortality from catch-and-release fishing by making public education materials available and establishing interpretive signs at all high-use fishing access points. Increase education efforts during the steelhead fishing season when bait is allowed for steelhead angling. Education materials should include information on bull trout identification, fishing regulations, agency contacts, and appropriate catch-and-release handling techniques. Continue cooperating on education projects with the Native American Tribes, the U.S. Forest Service, the Washington Department of Fish and Wildlife, the Service, anglers, other recreational organizations, and local newspapers.

Upper Grande Ronde River Core Area

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

Forest Management and Agricultural Practices

1.1.1 Restore and protect riparian zones associated with bull trout habitat. Re-vegetate to restore shade and canopy, riparian cover, and native vegetation (*e.g.*, Catherine Creek between Union and the State park, Indian Creek below the forest boundary). This component is vital to restoring not only shade but also natural instream processes, hydrologic function, and thermal regimes. Follow recommendations identified in The Upper Grande Ronde Water Quality Management Plan (GRWQC 2000) and Stream and Riparian Conditions in the Grande Ronde Subbasin (Huntington 1994) for areas prioritized for re-vegetation and restoration. Work with Natural Resources Conservation Service to increase enrollment of landowner participation.

1.1.2 Identify and reduce sources of excessive fine sediment delivery. Roads, grazing, and agricultural practices are main sources of excessive fine sediment in the Upper Grande Ronde Core Area. Focus on known or suspected spawning and rearing areas and address the most serious problems first. Also, address sedimentation issues in the SF Catherine Creek ditch, Indian Creek below the Forest boundary and Catherine Creek between Union and the State Park. Use existing Oregon Department of Transportation, U.S. Forest Service, Boise Cascade, and Wallowa and Union counties road assessments to identify where actions are necessary to correct problems with roads. The Upper Grande Ronde Water Quality Management Plan, as well as the Upper Grande Ronde Agricultural Water Quality Plan provides guidance on problem locations and remedies. Stabilize roads, crossings and railroad grades; remove and vegetatively restore unneeded road and railroad grades.

Livestock Grazing

1.1.3 Reduce grazing impacts. Fencing, changes in timing, and the use of riparian pastures, off site watering and salting, and other measures can be used to minimize grazing impacts. Federal land management agencies should fully implement PACFISH/INFISH standards and guidelines for livestock grazing, as appropriate. Evaluate ongoing allotment management for effects to bull trout and bull trout critical habitat. Modify management as needed, to reduce or eliminate effects that would retard recovery of bull trout populations and/or bull trout designated critical habitat. Conduct implementation and effectiveness monitoring, using accepted interagency monitoring protocols currently in use in the Upper

Grande Ronde Basin. Apply monitoring results to modify allotment management as necessary. Work with landowners in the upper Grande Ronde River and Indian Creek below the forest boundary to reduce grazing impacts.

1.2. Instream Impacts

Legacy Forest Management Practices

1.2.1 <u>Implement stream restoration projects in degraded stream reaches</u>. Review habitat information to identify and prioritize opportunities for stream restoration. Design and implement projects based on findings. National Forest lands and private lands containing bull trout habitat need to be assessed. Ongoing restoration activities as they relate to salmon and steelhead are already in progress. Restoration activities should focus on: increasing instream habitat complexity, off-channel habitat, and high flow refugia by adding large wood; managing riparian areas for a future supply of large wood, adequate shade, and diverse allochthonous inputs; and reducing fine sediment and water quality impacts from roads and land use activities.

Agricultural Practices

1.2.2 <u>Improve and secure appropriate instream flows</u>. Improving instream flows will help restore connectivity, decrease water temperatures and create higher quality habitat providing bull trout with more opportunities for migration and habitat for rearing. Work with the Natural Resources Conservation Service, Oregon Water Resources Department and landowners on a voluntary basis to secure more instream water rights for fish use, and lease water from water right holders during critical period to supplement minimum (no) flow. Utilize Oregon Department of Fish and Wildlife's streamflow restoration prioritization ranking developed for the Grande Ronde River subbasin. Work with irrigators and landowners to improve irrigation efficiency and restore flow from water withdrawal. Target Catherine and Indian Creeks and the Mainstem Grande Ronde River Valley.

1.3. Water Quality

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

Temperature Barriers & Low Flow

2.1.1 <u>Implement stream, riparian, and flow restoration measures described in section one to remedy temperature and low flow barriers</u>, particularly in the FMO habitats of the Mainstem Grande Ronde River and Catherine Creek.

2.2. Fisheries Management

2.3. Small Population Size

2.4. Forage Fish Availability

3. Actions to Address Nonnative Fishes

None

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.1.1 Evaluate habitat condition and determine bull trout use of the Grande Ronde Valley. Assess habitat conditions in the Grande Ronde River between La Grande and Elgin. Determine how, when, and in what capacity bull trout use this portion of the river. Determine if conditions (*e.g.*, thermal) in this area prevent or inhibit the migration of fluvial bull trout. Determine if bull trout from the upper Grande Ronde River, Indian Creek and Catherine Creek, are connected to each other.

4.2 Demographic

4.2.1 Assess current status of resident and migratory bull trout in the Upper Grande Ronde Core Area. Monitoring efforts in recent years have diminished and the current picture of status in the core areas is vague at best. The unknown status of bull trout is a critical uncertainty for the Upper Grande Ronde Core Area.

4.2.2 Develop a long term monitoring program to assess distribution, status and trend of bull trout in the Upper Grande Ronde Core Area. Collaborate with partners to develop a rigorous and cost effective monitoring plan capable of detecting change in demographic metrics and effectiveness of recovery efforts. Coordinate with efforts to develop a region-wide monitoring plan.

4.2.3 Identify local populations in the Upper Grande Ronde Core Area. Population structure in the Upper Grande Ronde Core Area is uncertain. Complete the genetic analysis to define population and metapopulation structure.

4.2.4 Determine the distribution of bull trout, particularly in systems of unknown distribution. Further define the spawning distribution of bull trout within the core area, particularly in the Upper Grande Ronde River, Catherine Creek and where there is potential for undetected populations.

4.3 Nonnatives

4.3.1 Determine distribution of brook trout in the Upper Grande Ronde Core Area. At this time brook trout in the Upper Grande Ronde Core Area are thought not to pose a primary threat to bull trout, however their distribution is not well defined. Determine the distribution of bull trout and brook trout and identify reaches where both species co-occur. If sympatry is found to occur on the spawning grounds, evaluate rates of hybridization.

Conservation Recommendations

- Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist. While working groups may be facilitated by any interested stakeholder, most often they are organized and facilitated by the Service, a State agency, U.S. Forest Service, or a Tribal entity. Although the Service has no guidelines for format or process, existing working groups are largely informal, are organized at various scales (*e.g.*, core area, river basin, geographic region, or recovery unit) and generally meet at least annually.

- Addresses passage and screening issues. Connectivity impairment by physical instream barriers (*i.e.*, diversions, dams & weirs) was not identified as a primary threat to bull trout in the Upper Grande Core Area at this time; however passage problems at diversions, irrigation ditches, dams and culverts could pose a concern for bull trout migrating throughout the core area. The following actions are recommended to maintain connectivity within the core area.

  - Continue to assess irrigation diversions as passage barriers and remedy where necessary; areas of priority include diversions on Indian and Catherine Creeks.

  - Continue to assess the need for screens on diversions and hatchery intakes and screen where necessary; areas of priority include hatchery intakes in the Upper Grande Ronde River and Catherine Creek and diversions in Indian and Catherine Creeks.

  - Continue evaluation of hatchery weirs on bull trout and reduce impacts. The operation of weirs in Catherine Creek and Upper Grande Ronde River may be influencing the spawning distribution and spawning time of bull trout. Assess and remedy if necessary.

  - Continue to assess road crossing acting as barrier to bull trout movement and provide passage where feasible. Areas of priority include tributaries of the Upper Grande Ronde Core Area, culverts on North Fork Campground Catherine Creek (North Fork Campground), EF Indian Creek, and Indiana Creek.

Wallowa/Minam Core Area

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.2. Instream Impacts

1.3. Water Quality

Agricultural Practices

1.3.1 Restore and protect riparian zones associated with bull trout habitat. Re-vegetate to restore shade and canopy, riparian cover, and native vegetation in all bull trout spawning, rearing and migration areas. This component is vital to restoring not only shade but also natural instream processes, hydrologic function, and thermal regimes. Priority sites include the Wallowa River watershed, Little Bear Creek from mouth to Allen Canyon ditch and Bear Creek downstream of mouth of Little Bear Creek. Follow recommendations identified in The Upper Grande Ronde Water Quality Management Plan (GRWQC 2000) and Stream and Riparian Conditions in the Grande Ronde Subbasin (Huntington 1994) for areas prioritized for re-vegetation and restoration. Work with Natural Resources Conservation Service to increase enrollment of landowner participation.

1.3.2 Implement stream restoration projects in degraded stream reaches. Stream channel and floodplain restoration is necessary to effectively address hydrologic processes related to the reduction of temperatures and increased hyporheic flow. Review habitat information to identify and prioritize opportunities for restoration. Design and implement projects based on findings. Prioritize actions in the Wallowa River. Ongoing restoration activities as they relate to salmon and steelhead are already in progress. Restoration activities should focus on: increasing instream habitat complexity, off-channel habitat, and high flow refugia by adding large wood; increasing sinuosity; managing riparian areas for a future supply of large wood, adequate shade, and diverse allochthonous inputs; and reducing fine sediment and water quality impacts from roads and land use activities.

1.3.3 Improve and secure appropriate instream flows. Improving instream flows will help restore connectivity, decrease water temperatures and create higher quality habitat and create more suitable rearing and migration habitats for bull trout. Develop an inventory of water rights that may be reallocated for the benefit of bull trout and other salmonids. Work with the Natural Resources Conservation Service, Oregon Water Resources

Department and landowners on a voluntary basis to secure more instream water rights for fish use, and lease water from water right holders during critical period to supplement minimum (no) flow. Utilize Oregon Department of Fish and Wildlife's streamflow restoration prioritization ranking developed for the Grande Ronde River Subbasin.

1.3.4 Implement irrigation water efficiency projects to increase instream flows. Work with irrigators and private landowners to improve irrigation efficiency and allow conserved water to be used for instream purposes.

1.3.5 Monitor the effects of diversions and water withdrawals on stream temperature and bull trout migration, and modify operation as necessary. Manage the Lostine and Wallowa Rivers to provide flows and water temperatures necessary to support upstream migration of bull trout.

2. Actions to Address Demographic Threats

None

3. Actions to Address Nonnative Fishes

3.1 Nonnative Fishes

Hybridization & Competition

3.1.1 Assess the distribution of brook trout and bull trout and determine rates of hybridization in reaches where they co-occur. Brook trout are widespread throughout the spawning tributaries of both the Minam and Wallowa Rivers; they are present in all populations except Deer Creek. Hybridization has been documented in the upper Wallowa River and Hurricane Creek, and may occur elsewhere but has gone undetected. Determine the distribution of brook trout and bull trout and assess rates of hybridization where they are sympatric.

3.1.2 Implement management actions to reduce, control or eradicate brook trout where necessary and feasible. Task 3.1.1 will provide information necessary to determine locations in which actions to reduce or eliminate brook trout are appropriate.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.2.1 Evaluate incidental catch and illegal harvest from recreational angling. Incidental catch and illegal harvest of bull trout may occur in recreational fisheries. The extent and severity of the problem is unknown. Implement a survey to document rates of incidental catch and illegal harvest particularly during June through late fall.

4.2.2 Assess current status and distribution of resident and migratory bull trout in the Wallowa/Minam Core Area. Monitoring efforts in the core area are inconsistent. The status of bull trout in some populations, such as the Minam River, is unknown.

4.2.3 Develop a long term monitoring program to assess distribution, status and trend of bull trout in the Wallowa/Minam Core Area. Collaborate with partners to develop a rigorous and cost effective monitoring plan capable of detecting change in demographic metrics and effectiveness of recovery efforts. Coordinate with efforts to develop a region-wide monitoring plan.

4.2.4 Identify local populations in the Wallowa/Minam Core Area. Population structure in the Wallowa/Minam Core Area is uncertain. Complete the genetic analysis to define population and metapopulation structure.

4.2.5 Continue monitoring, maintenance and operation of fish screens on all diversions and passage facilities. To prevent entrainment consistent monitoring and maintenance is necessary to keep fish screens operating properly and effectively.

4.3 Nonnatives

Conservation Recommendations

- Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist. While working groups may be facilitated by any interested stakeholder, most often they are organized and facilitated by the Service, a State agency, U.S. Forest Service, or a Tribal entity. Although the Service has no guidelines for format or process, existing working groups are largely informal, are organized at various scales (*e.g.*, core area, river basin, geographic region, or recovery unit) and generally meet at least annually.

- Identify and reduce sources of excessive fine sediment delivery. Although sediment was not identified as a primary threat to bull trout in this core area, it is considered a threat or concern in the FMO habitat and may have a direct impact on the forage species for bull trout. Areas of concern include, but are not limited to, Prairie Creek and Bear Creek. Sources include irrigation returns, grazing activities and roads. The Lower Grande Ronde Water Quality Management Plan provides guidance on problem locations and remedies. Stabilize roads, crossings and railroad grades; remove and vegetatively restore unneeded road and railroad grades.

- Reduce grazing impacts. In light of reducing fine sediment delivery and decreasing stream temperatures for the benefit of bull trout, reduce impacts of livestock grazing on instream habitat. Although livestock grazing was not identified as a primary threat, it is an issue of concern. Employ existing alternatives (*e.g.*, fencing, changes in timing and use of riparian pastures, off site watering and salting) to reduce grazing impacts to bull trout. Work with landowners in Little Bear Creek from mouth to Allen Canyon ditch, Bear Creek downstream of mouth of Little Bear Creek, and the Wallowa River upstream of Enterprise to reduce grazing impacts.

- Addresses passage and screening issues. Connectivity impairment was not identified as a primary threat to bull trout in the Wallowa/Minam Core Area at this time; however diversions, irrigation ditches, dams and culverts can pose passage problems for bull trout migrating throughout the core area, particularly in the Wallowa River basin. The following actions are recommended to maintain connectivity within the core area.

    - Continue to assess irrigation diversions as passage barriers and remedy where necessary; areas of priority include Wallow River between Hurricane Creek and Wallowa Dam, Consolidated Ditch on Hurricane Creek, and diversions on Lostine/Bear Creek.

    - Continue to assess the need for screens on diversions and hatchery intakes and screen where necessary; areas of priority include the Wallowa Fish Hatchery, the Big Canyon Lostine River Satellite Facility, Wallowa River between Hurricane Creek and Wallowa Dam, Consolidated Ditch on Hurricane Creek, and diversions on Lostine/Bear Creek.

    - Continue evaluation of hatchery weirs on bull trout and reduce impacts. The operation of the Lostine River weir may be influencing the spawning distribution and spawn timing of bull trout. Assess and remedy if necessary.

Little Minam Core Area

1. Actions to Address Habitat Threats

None

2. Actions to Address Demographic Threats

None

3. Actions to Address Nonnative Fishes

None

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.2.1 Develop a long term monitoring program to assess distribution, status and trend of bull trout in the Little Minam Core Area. While the status of bull trout in the Little Minam Core Area may not require frequent monitoring, some low level and regular survey should occur. Coordinate with efforts to develop a region-wide monitoring plan.

4.2.2 Identify local populations in the Little Minam Core Area. Population structure in the Little Minam Core Area is uncertain. Current thinking assumes one population exists in the core area; however, a finer population structure could exist in which Dobbin Creek may be a separate population. Complete a genetic analysis to define population and metapopulation structure.

4.3 Nonnatives

Conservation Recommendations

- Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist. While working groups may be facilitated by any interested stakeholder, most often they are organized and facilitated by the Service, a State agency, U.S. Forest Service, or a Tribal entity. Although the Service has no guidelines for format or process, existing working groups are largely informal, are organized at various scales (*e.g.*, core area, river basin, geographic region, or recovery unit) and generally meet at least annually.

- Assess current risk of catastrophic fire to the Little Minam bull trout population. Given the Little Minam is a simple core area, containing just one population in a small area, the core area is at high risk of stochastic environmental events, such as catastrophic fire. Assess risk of catastrophic fire and, where identified and allowed under management plans, implement forest management to reduce and minimize risks.

Lookingglass/Wenaha Core Area

1. Actions to Address Habitat Threats

None

2. Actions to Address Demographic Threats

None

3. Actions to Address Nonnative Fishes

None

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.2.1 <u>Evaluate incidental catch and illegal harvest by recreational anglers.</u> Incidental catch and illegal harvest of bull trout may occur in recreational fisheries. The extent and severity of the problem is unknown. Implement a survey to document rates of incidental catch and illegal harvest particularly during June through late fall.

4.2.2 <u>Develop a long term monitoring program to assess distribution, status and trend of bull trout in the Lookingglass/Wenaha Core Area</u>. Collaborate with partners to develop a rigorous and cost effective monitoring plan capable of detecting change in demographic metrics and effectiveness of recovery efforts. Coordinate with efforts to develop a region-wide monitoring plan.

4.2.3 <u>Identify local populations in the Lookingglass/Wenaha Core Area</u>. Population structure in the Lookingglass/Wenaha Core Area is uncertain. Conduct a genetic analysis to define population and metapopulation structure.

4.2.4 <u>Determine the distribution of bull trout, particularly in systems of unknown distribution</u>. Further define the spawning distribution of bull trout within the core area, particularly the Wenaha River.

4.2.5 <u>Investigate use of the mainstem Snake River by bull trout from the Lookingglass/Wenaha Core Area</u>. It is essential to understand how important this area is in the life history of bull trout. This should be done in conjunction with studies on bull trout from adjacent core areas to determine areas of overlapping use and possible interactions.

4.2.6 <u>Assess whether operation of the Lookingglass Hatchery weir is having an adverse impact on bull trout</u>. The Lookingglass Creek Hatchery weir is a passage barrier. Bull trout must be handled and passed over the weir to move upstream. Delay and handling may influence the distribution and timing of bull trout spawning. Operation of the weir on Lookingglass Creek may also decrease forage base for bull trout by restricting access of anadromous fish to upstream reaches. Minimize handling and retention time of bull trout and continue to operate the weir during the entire upstream migration period of bull trout.

4.3 Nonnatives

4.3.1 Assess the distribution and interaction between bull trout and brook trout in Lookingglass Creek. Brook trout are present in Lookingglass Creek; however the extent of their distribution is unknown. Assess the distribution of brook trout and bull trout in Lookingglass Creek. If spawning distribution overlaps evaluate rates of hybridization.

Conservation Recommendations

- Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist. While working groups may be facilitated by any interested stakeholder, most often they are organized and facilitated by the Service, a State agency, U.S. Forest Service, or a Tribal entity. Although the Service has no guidelines for format or process, existing working groups are largely informal, are organized at various scales (*e.g.*, core area, river basin, geographic region, or recovery unit) and generally meet at least annually.

- Promote and support water quality improvement actions in the Upper Grande Ronde Core Area. Poor water quality conditions related to temperature, nutrients and low flows in the Lower Grande Ronde River are a direct result of land use and management in the Upper Grande Ronde Valley.

- Ensure that hatchery intakes are screened properly and are not impacting bull trout. Assess the impacts to bull trout of operating hatchery intakes at Lookingglass Fish Hatchery. Ensure the screens on the intakes are properly operated and maintained.

- Design and implement modifications to the Lookingglass Fish Hatchery weir and/or its timing of operation to minimize or eliminate adverse impacts, if an assessment of the weir suggests adverse impacts to bull trout are occurring (RM&E action 4.2.6 above.

Imnaha River Core Area

1. Actions to Address Habitat Threats

None

2. Actions to Address Demographic Threats

None

3. Actions to Address Nonnative Fishes

None

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.1.1 Evaluate the impacts of Lower Granite Dam and Hells Canyon Dam. Bull trout from the Imnaha core area access the mainstem of the Snake River. However, bull trout use of the Snake River, their interaction with dams, and the impacts of hydropower facility operation have not been well described or understood. Implement studies and recommendations generated by the Hells Canyon Dam FERC relicensing process to minimize the impact of Hells Canyon Dam on bull trout rearing and movement.

4.2 Demographic

4.2.1 Continue to evaluate the impacts of the hatchery intakes at ODFW's Imnaha Satellite Facility. Complete screening of hatchery intakes.

4.2.2 Evaluate incidental and illegal catch from recreational angling. The Imnaha River is one of few places where catch and release of bull trout is legal and bull trout are caught incidentally in the Chinook fishery in spring and early summer. Survey rates of incidental and illegal catch particularly during June through late fall.

4.2.3 Continue to monitor bull trout in the Imnaha Core Area. Periodically survey bull trout in existing or potential habitat where their status is uncertain or recolonization might occur as bull trout number increase.

4.2.4 Conduct a genetic analysis of bull trout in the Imnaha River basin. Population structure in the Imnaha River core area is uncertain for questions exist whether the core area is structured as a single population or more finely structured as many. Design and conduct a genetic analysis study to define population and metapopulation structure. Determine the consequences of genetic fragmentation caused by the Wallow Valley Improvement Canal and natural barriers.

4.2.5 Evaluate the influence of the Imnaha Weir on bull trout migration consistent with term and conditions in the 2015 Service biological opinion on operation and maintenance of the weir.

4.3 Nonnatives

Conservation Recommendations

- Remedy impaired connectivity issues associated with the Wallowa Valley Improvement Canal. The canal bisects the upper reaches of Big Sheep, Little Sheep, and McCully Creek, capturing water from all three streams and transporting it to the Wallowa River basin. All of the water in McCully Creek is captured by the canal. The diversions not only act as barriers to migration, fragmenting distribution in each stream, but also entrain bull trout. Evaluate reasonable and feasible options to restore passage and eliminate entrainment in all streams affected by the canal. Also restore instream flows below the diversion by purchasing or leasing water rights.

- Salvage bull trout in areas where fish become stranded due to low flow conditions (*e.g.*, the Wallowa Valley Improvement Canal).

- Protect and restore riparian zones within bull trout habitat. Manage streams in a manner designed to maintain existing riparian growth and function. These streams would include Big Sheep Creek, Little Sheep Creek, and the Imnaha River and their tributaries.

- Reduce grazing impacts. Bull trout in certain portions of the Imnaha Core Area are also threatened by bank trampling leading to increased sedimentation and reduced riparian habitat that results in channel widening, and increased water temperatures from historical and current grazing practices. Fencing, changes in timing, the use of riparian pastures, off site watering and salting, and other measures can be used to minimize grazing impacts. Evaluate ongoing allotment management for effects to bull trout and bull trout critical habitat. Modify management as needed, to reduce or eliminate effects that would retard recovery of bull trout populations and/or bull trout designated critical habitat. Conduct implementation and effectiveness monitoring using accepted interagency monitoring protocols currently in use in the core area. Apply monitoring results to modify allotment management as necessary.

- Identify and remedy sources of sediment delivery where necessary and feasible. Roads are one potential source of sediment in the Imnaha Core Area. Use existing Oregon Department of Transportation as well as proposed U.S. Forest Service road assessments to identify areas where action is necessary to correct problems associated with roads. Forest Service Road 3900-023 is one of many potential sources. Naturally occurring landslides in the wilderness area of the upper Imnaha subbasin are also a significant source. Use existing habitat surveys to identify problem areas and remedy where possible.

- Identify and replace culverts that create barriers to movement of juvenile and adult bull trout.

Powder River Core Area

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

Legacy Forest Management Practices & Agricultural Practices

1.1.1 Restore shade and canopy cover provided by riparian vegetation along stream reaches where riparian habitats have been degraded. Various land use activities have degraded riparian habitats by removing vegetation, which has reduced the amount of shade and canopy cover of some stream reaches. This component is vital to restoring not only shade but also natural hydrologic processes and function. Examples of streams where revegetating select reaches would improve both aquatic and riparian habitats to benefit bull trout include the mainstem Powder River above Haines; North Powder River below Anthony Creek; Boulder Creek and mainstem stream reaches of the Powder River that may provide overwintering areas for bull trout.

1.1.2 Evaluate potential effects of degraded upland areas on stream and riparian habitats and implement actions, where appropriate, to restore diverse native vegetation communities and processes. Some land management practices (*e.g.*, grazing and timber management) have degraded upland areas or produced conditions that have, or have the potential to, negatively affect stream and riparian habitats. These areas should be evaluated and actions to restore diverse native vegetation types and processes (*e.g.*, fire regime) should be implemented to benefit bull trout and bull trout habitat. Efforts to implement this task should be coordinated with existing monitoring and restoration plans and programs such as those implemented by the BLM and USFS.

1.1.3 Assess and address threats of sediment production from roads and other sources (*e.g.*, mines, improperly grazed areas, inappropriate use of recreational vehicles) known to be contributing sediment to streams. Roads and other sources of sediment delivery to streams have been identified in a number of assessments in Powder River Core Area (*e.g.*, assessments conducted by the Powder Basin Watershed Council, U.S. Forest Service travel management plans, and or during the Total Maximum Daily Load processes). Wolf Creek, Upper Powder River (density and location of roads), and the North Powder River Road are areas of concern. Activities such as removing unnecessary roads, stabilizing road crossings, improving road surfaces, relocating roads out of sensitive riparian areas, restricting recreational vehicles, and altering grazing practices should be used to reduce sediment delivery to streams.

Livestock Grazing

1.1.4 Reduce Grazing Impacts. Improper grazing practices have degraded aquatic and riparian habitats through such activities as removal of riparian vegetation, and increases in sedimentation and stream bank instability Fencing, changes in timing, the use of riparian pastures, off site watering and salting, and other measures can be used to minimize grazing impacts. Federal land management agencies should fully implement

PACFISH/INFISH standards and guidelines for livestock grazing, as appropriate. Evaluate ongoing allotment management for effects to bull trout and bull trout critical habitat. Modify management as needed, to reduce or eliminate effects that would retard recovery of bull trout populations and/or bull trout designated critical habitat. Conduct implementation and effectiveness monitoring, using accepted interagency monitoring protocols currently in use in the Powder River Basin. Apply monitoring results to modify allotment management as necessary. Examples of areas where habitats have been degraded include certain reaches of Deer Creek and Lower Powder River.

1.2. Instream Impacts

Agricultural Practices

1.2.1 Restore floodplain function and channel complexity in areas utilized, or potentially utilized, by bull trout. Review habitat information to identify and prioritize opportunities for stream and floodplain restoration. The effects of stream channelization, agricultural and urban development, and mining have degraded stream habitats by confining and straightening channels, reducing recruitment of large wood, and simplifying habitat. Full floodplain (*e.g.,* hillslope toe to hillslope toe) restoration is necessary to reduce water temperature and increase hyporheic flow connectivity which buffers temperature affects annually and reduces variance of daily temperature fluxes, as well as to increase habitat heterogeneity. Examples of areas affected by channelization for agricultural and urban development include the Powder River Valley and lower reaches of streams along the Elkhorn Mountain front (*e.g.*, Big Muddy Creek, Rock Creek, Pine Creek, and Salmon Creek), and areas affected by mining include Cracker Creek and the Powder River upstream of Phillips Reservoir. Actions should address improving riparian vegetation and recruitment of large wood debris in streams (where appropriate), and encouraging the restoration of characteristics of natural stream channels.

Mining Activities

1.2.2 Assess and monitor mine sites for potential negative effects on bull trout and bull trout habitats and rehabilitate sites determined to be problems. Mines within the Upper Powder River local population and numerous other historically (*e.g.*, Argonaut, Sumpter Valley) and currently active mine sites throughout the Powder River Core Area may be negatively affecting bull trout through sedimentation and acidic or toxic discharge originating from tailings and other waste products. Previous site characterization/investigation efforts by such agencies as the Oregon Department of Environmental Quality should be reviewed and catalogued. Investigations should be conducted to collect any additional data needed to thoroughly evaluate mining sites, and problem areas should be remedied if necessary.

1.2.3 Curtail unauthorized instream mining activity. Unauthorized mining activity is widespread throughout the Powder River core area and likely impacts bull trout and bull trout habitat. Implement regulations designed to reduce or eliminate violations of mining permits and unauthorized mining.

1.3. Water Quality

Dewatering

1.3.1 Improve and secure instream flows. Increased instream flow is a necessary condition to improving water quality and decreasing stream temperature and plays a critical role in reducing long-term impacts from climate change. Develop an inventory of water rights that may be reallocated for the benefit of bull trout. Secure water rights through purchase or lease. Improve efficiency of agriculture water use and allow conserved water to be used for instream purposes. Reduce diversions where necessary and feasible. Implement riparian and channel restoration actions as identified in sections 1.1 and 1.2. Benefits of stream channel restoration will include raising the water table, restoring natural instream flow and providing higher flows during summer and late fall.

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

Passage Issues & Entrainment

2.1.1 Inventory and identify water diversion structures and ditches affecting bull trout and implement actions to remedy entrainment and passage issues. Numerous water diversions and ditches in the Powder River basin have not been evaluated for their effects on bull trout (*e.g.*, as passage barriers and sites of entrainment). Diversions and ditches should be inventoried, evaluated, and actions implemented to screen or provide passage, unless maintaining them is perceived to be beneficial to bull trout (*e.g.*, separation of brook trout and bull trout populations until the threat posed by brook trout can be eliminated). Examples of areas where water diversion structures are known to be fish passage barriers include the North Powder River, Powder River, and the Anthony Creek and North Anthony Creek watersheds.

2.1.2 Inventory and assess road crossings to identify fish passage barriers and implement actions to provide passage where appropriate. Update inventory of road crossings on Federal lands and State and county roads (See USFWS [2004] and Mirati [1999]). Actions to provide fish passage at all identified fish passage barrier sites should be implemented. Develop a program to provide passage where necessary (*e.g.*, through placement of appropriate size and properly functioning culverts).

2.1.3 Evaluate alternatives for improving stream function and fish passage in lower Deer Creek including an evaluation of removing the old highway road bed on Deer Creek into Philips Reservoir. Implement Conservation Recommendations outlined in the 2014 Service Biological Opinion to restore bull trout foraging, overwintering and migratory habitat in the mouth of Deer Creek (USFWS 2014b). Remove two abandoned road beds that currently act as seasonal fish passage barriers into Phillips Reservoir.

Dewatering and Temperature Barriers

2.1.4 Identify dewatered areas where insufficient stream flow creates passage barriers, and develop and implement actions to provide fish passage. Reduced stream flows from water diversions create fish passage barriers (*e.g.*, through either complete drying of streams or contributing to unsuitable habitat conditions) in numerous areas of the Powder River Core Area. These areas should be assessed relative to instream flow needs of bull trout and opportunities to eliminate passage barriers should be developed and pursued. Implement in conjunction with action 1.3.1.

2.2. Fisheries Management

2.3. Small Population Size

We expect the implementation of the actions identified in this recovery plan will be sufficient to increase population size and maintain gene flow among populations and will ameliorate any deleterious effects of genetic and demographic stochasticity in addition to recovering the migratory life history type. Additional measures, such as population augmentation or reintroduction within historical distribution, should be considered in the event a demographic response to these actions is not observed.

2.4. Forage Fish Availability

3. Actions to Address Nonnative Fishes

3.1 Nonnative Fishes

Hybridization & Competition

3.1.1 Evaluate presence/absence of brook trout in bull trout habitat. Brook trout are widespread throughout the core area. Further define the distribution of bull trout, brook trout, and hybrids in the Powder River Core Area targeting Big Muddy Pine, Upper Cracker and Little Cracker Creeks.

3.1.2 <u>Assess severity of threat due to hybridization with brook trout where the two species co-occur in the Powder River Basin</u>. Assess hybridization rates and the degree of introgression. Implement in conjunction with action 4.2.3.

3.1.3 <u>Implement brook trout removal, control or eradication efforts wherever feasible and biologically supportable</u>. Based on results of actions 3.1.1 and 3.1.2, identify sites where the eradication or control of brook trout will be beneficial, effective and feasible. Develop a comprehensive core area-wide strategy that prioritizes stream reaches where success will be most likely and where threats to existing populations are most significant. Consider the removal of brook trout from lakes that spill into bull trout occupied streams.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.1.1 <u>Evaluate bull trout use of reservoirs in the Powder River Core Area</u>. Three reservoirs exist in the Powder River basin; Thief Valley (BOR), Phillips (BOR), and Wolf Creek (Powder Valley Water Control District). Bull trout are not considered to occupy Thief Valley and Wolf Creek reservoir given impaired connectivity and inhospitable conditions. Use of Phillips Reservoir is unknown. Two bull trout were documented in Phillips Reservoir in 2011. Continue to implement the Terms and Conditions of the 2014 Biological Opinion (USFWS 2014b) to develop and implement a 5-year sampling plan to better determine bull trout use of Phillips Reservoir.

4.1.2 <u>Continue to monitor water quality downstream of mine sites</u>. Target Cracker Creek upstream of Silver Creek and Upper Powder River between Sumpter and Philips Reservoir.

4.2 Demographic

4.2.1 <u>Develop a long term monitoring program to assess distribution, status and trend of bull trout in the Powder River Core Area</u>. Collaborate with partners to develop a rigorous and cost effective monitoring plan capable of detecting change in demographic metrics and effectiveness of recovery efforts. Coordinate with efforts to develop a region-wide monitoring plan.

4.2.2 <u>Conduct surveys in areas where bull trout status is unknown and that have potential spawning and rearing habitat</u>.

4.2.3 <u>Conduct an investigation of bull trout genetics in the Powder River Core Area</u> to identify population structure, establish a genetic baseline, document introgression with brook trout and inform decisions around brook trout suppression and eradication, barrier removal and bull trout supplementation.

4.3 Nonnatives

4.3.1 Continue monitoring Tiger Muskie in Phillips Reservoir. Tiger Muskie were introduced into Phillips Reservoir as a method to control populations of yellow perch. Continue population monitoring of Tiger Muskie and consider results in relation to action 4.1.1 to gain an understanding of possible effects to bull trout.

Conservation Recommendations

- Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist. While working groups may be facilitated by any interested stakeholder, most often they are organized and facilitated by the Service, a State agency, U.S. Forest Service, or a Tribal entity. Although the Service has no guidelines for format or process, existing working groups are largely informal, are organized at various scales (*e.g.*, core area, river basin, geographic region, or recovery unit) and generally meet at least annually.

- Increase information outreach to anglers. Provide information on bull trout identification, special regulations, methods to reduce hooking mortality of bull trout caught incidentally, and the value of bull trout and their habitat. Education and outreach designed to assist anglers in identifying and differentiating captured brook trout from bull trout is needed to reduced unintended take of bull trout.

Pine, Indian and Wildhorse Core Area

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.2. Instream Impacts

Dewatering

1.2.1 Improve and secure instream flows. Water withdrawal at numerous diversion dams creates chronic low flow conditions in all tributaries. Increased instream flow is a necessary condition to improving water quality, instream habitat, and migration opportunities and as well as decreasing stream temperature. Restoring normative instream flow also plays a critical role in reducing the long-term impacts from climate change. Develop an inventory of water rights that may be reallocated for the benefit of bull trout. Secure water rights through purchase or lease. Improve efficiency of agriculture water use and allow conserved water to be used for instream purposes. Reduce diversions where necessary and feasible.

1.3. Water Quality

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

Passage Issues & Entrainment

2.1.1 Inventory and identify water diversion structures and ditches affecting bull trout and implement actions to remedy entrainment and passage issues. Numerous water diversions, push up dams, and ditches in the Pine/Indian/Wildhorse Core Area are responsible for the isolation and fragmentation of local populations. Direct mortality relative to entrainment and dewatering significantly impact the migratory portion of the populations. Inventory and assess all diversions for their effects on bull trout (*e.g.*, as passage barriers and sites of entrainment). Implement actions to screen or provide passage, unless maintaining them is perceived to be beneficial to bull trout (*e.g.*, separation of brook trout and bull trout populations until the threat posed by brook trout can be eliminated). Encourage landowner participation in programs to replace push-up dams with permanent screened and passable structures.

2.1.2 Investigate and implement methods to provide two-way fish passage at Hells Canyon and Oxbow dams. Two-way fish passage is necessary at Oxbow Dam to establish connectivity of bull trout local populations in the Wildhorse River basin with other local populations within the Pine/Indian/Wildhorse Core Area. Passage at Hells Canyon Dam provides connectivity to other core areas in the Snake River, including the Imnaha. Implement actions associated with improving connectivity in the Snake River FMO identified in Idaho Power's FERC relicense agreement for the Snake River Dams.

Dewatering and Temperature Barriers

2.1.3 Identify dewatered areas where insufficient stream flow creates passage barriers, and develop and implement actions to provide fish passage. Reduced stream flows from water diversions create fish passage barriers (*e.g.*, through either complete drying of streams or contributing to unsuitable habitat conditions) in numerous areas of the Pine/Indian/Wildhorse Core Area. These areas should be assessed relative to instream flow needs of bull trout and opportunities to eliminate passage barriers should be developed and pursued. Implement in conjunction with action 1.3.1.

2.2. Fisheries Management

2.3. Small Population Size

2.4. Forage Fish Availability

3. Actions to Address Nonnative Fishes

3.1 Nonnative Fishes

Hybridization & Competition

3.1.1 Evaluate presence/absence of brook trout in bull trout habitat. Brook trout are present in all populations of the core area. Further define the distribution of bull trout, brook trout, and hybrids in the Pine/Indian/Wildhorse Core Area.

3.1.2 Assess and monitor the severity of threat due to hybridization with brook trout where the two species co-occur in the Pine/Indian/Wildhorse Core Area. Assess hybridization rates and the degree of introgression. Implement in conjunction with action 4.2.3.

3.1.3 Plan and implement brook trout removal, control or eradication efforts wherever feasible and biologically supportable. Based on results of actions 3.1.1 and 3.1.2, identify sites where the eradication or control of brook trout will be beneficial, effective and feasible. Develop a comprehensive core area-wide strategy that prioritizes stream reaches where success will be most likely and where threats to existing populations are most significant.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.2.1 Develop a long term monitoring program to assess distribution, status and trend of bull trout in the Pine/Indian/Wildhorse Core Area. Collaborate with partners to develop a rigorous and cost effective monitoring plan capable of detecting change in demographic metrics and effectiveness of recovery efforts. Coordinate with efforts to develop a region-wide monitoring plan.

4.2.2 Conduct regular surveys in areas where bull trout status is unknown and those identified as having potential spawning and rearing habitat. Insufficient information is available to confidently describe the status (*e.g.*, abundance, distribution, population trends) and life history characteristics of bull trout in the Pine/Indian/Wildhorse Core Area. Regular surveys should be conducted in these areas, as well as in areas considered as having potential spawning and rearing habitat, to generate information on bull trout status and the establishment of additional local populations.

4.2.3 Conduct an investigation of bull trout genetics in the Pine/Indian/Wildhorse Core Area to identify population structure, establish a genetic baseline, document introgression with brook trout and inform decisions around brook trout suppression and eradication, and barrier removal.

4.3 Nonnatives

Conservation Recommendations

- Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist. While working groups may be facilitated by any interested stakeholder, most often they are organized and facilitated by the Service, a State agency, U.S. Forest Service, or a Tribal entity. Although the Service has no guidelines for format or process, existing working groups are largely informal, are organized at various scales (*e.g.*, core area, river basin, geographic region, or recovery unit) and generally meet at least annually.

- Increase information outreach to anglers. Provide information on bull trout identification, special regulations, methods to reduce hooking mortality of bull trout caught incidentally, and the value of bull trout and their habitat. Education and outreach designed to assist anglers in identifying and differentiating captured brook trout from bull trout is needed to reduced unintended take of bull trout.

- Restore shade and canopy cover provided by riparian vegetation along stream reaches where riparian habitats have been degraded. Although not identified as a primary threat, degraded riparian condition in portions of the core area impacts water temperature and instream habitat. Examples of streams where revegetating select reaches would improve both aquatic and riparian habitats to benefit bull trout include public lands along Clear, North Pine, East Pine, and Lake Fork Creeks in Pine Valley; Indian Creek (Idaho) and Wildhorse River and mainstem stream reaches of the Pine Creek that may provide overwintering areas for bull trout.

- Assess causes of the landslide on Lake Fork. Address and remedy causes if appropriate.

- Reduce Grazing Impacts. Bull trout in certain portions of the Pine-Indian-Wildhorse Core Area are also threatened by bank trampling leading to increased sedimentation and reduced riparian habitat that results in channel widening, and increased water temperatures from historical and current grazing practices. Impacts from grazing practices vary throughout the core area from relatively low to high; impacts are more significant in certain reaches of Clear Creek, East Pine Creek, and Lake Fork Creek. Fencing, changes in timing, the use of riparian pastures, off site watering and salting, and other measures can be used to minimize grazing impacts. Evaluate ongoing allotment management for effects to bull trout and bull trout critical habitat. Modify management as needed, to reduce or eliminate effects that would retard recovery of bull trout populations and/or bull trout designated critical habitat. Conduct implementation and effectiveness monitoring, using accepted interagency monitoring protocols currently in use in the core area. Apply monitoring results to modify allotment management as necessary.

- <u>Assess and monitor mine sites for potential negative effects on bull trout and bull trout habitats and rehabilitate sites determined to be problems</u>. Historical mining, particularly in upper Pine Creek and Indian Creek, has resulted in degradation of water quality through sedimentation and acidic or toxic discharge originating from tailing and other waste products. Site characterization/investigation efforts by such agencies as the Oregon Department of Environmental Quality should be reviewed and catalogued. Investigations should be conducted to collect any additional data needed to thoroughly evaluate mining sites, and problem areas should be remedied if necessary. Continue to monitor water quality downstream of mine sites, including the Cornucopia mine site.

Mainstem Columbia and Snake River FMO Habitat

Conservation Recommendations

- <u>Insure coordination with Columbia River Federal Power System projects, FERC relicensing projects, and other large scale projects that require salmonid mitigation efforts</u>. Consider bull trout in these planning operations. Develop projects in a coordinated manner to reduce redundancy for efficiency in spending funds.

- <u>Transboundary planning should take into consideration both positive and negative impacts to migratory bull trout located upstream and downstream of mainstem dams</u>.

- <u>Reduce entrainment at large dams and diversions.</u> Entrainment of adults and sub-adult bull trout occurs upstream and downstream at mainstem Columbia River and Snake dams and diversions. FERC relicensing and settlement agreements have reduced impacts to bull trout. Continued management and monitoring is necessary to maintain and further reduce the impacts from entrainment at large dams. Maintain and improve efforts to insure diversion screens are updated and functioning.

- Maintain and improve water quality in the mainstem Columbia and Snake Rivers and meet water quality standards. Address 303d listed reaches for stream temperature, paying attention to levels of DO for gas bubble disease and any increased temperatures that might occur from climate change. State, county, and city planners should work in a coordinated manner to maintain and improve upon storm water and sewage treatment facilities that reduce impacts to migrating bull trout and their prey.

Implementation Schedule for the Mid-Columbia Recovery Unit

The Implementation Schedule that follows describes recovery action priorities, action numbers, action descriptions, duration of actions, potential or participating responsible parties, total cost estimate and estimates for the next 5 years, if available, and comments. These tasks, when accomplished in conjunction with implementation of recovery actions in the other bull trout recovery units, will lead to recovery of bull trout in the coterminous United States as discussed in the Bull Trout Recovery Plan (USFWS 2015b).

Parties with authority, responsibility, or expressed interest to implement a specific recovery action are identified in the Implementation Schedule. Listing a responsible party does not imply that prior approval has been given or require that party to participate or expend any funds. However, willing participants will benefit by demonstrating that their budget submission or funding request is for a recovery action identified in an approved recovery plan, and is therefore part of a coordinated recovery effort to recover bull trout. In addition, section 7(a)(1) of the Endangered Species Act (Act) directs all Federal agencies to use their authorities to further the purposes of the Act by implementing programs for the conservation of threatened or endangered species.

<u>Interrelated Costs of Recovery Actions</u>

The costs of recovery within the Mid-Columbia Recovery Unit vary among core areas. Cost estimates identified can be a reflection of specific recovery costs solely for the purpose of bull trout recovery, shared costs with other species, or costs for actions that benefit bull trout but are implemented due to other legal or management obligations already in place. Recovery costs are directly related to the implementation of recovery actions identified to address primary threats to bull trout or to monitor bull trout populations within each core area. These costs are the Service's best estimate at the current time to implement these actions.

Recovery actions in core areas and FMO (foraging, migration, overwintering) habitat that contain both anadromous fish and bull trout reflect shared costs among all these species. The majority of the river basins in the Mid-Columbia Recovery Unit are accessible to anadromous fish (salmon and steelhead). The costs identified within those areas are costs that are shared with, or even driven by, salmon and steelhead recovery efforts. Many actions that are implemented for the recovery of anadromous fish (*e.g.*, fish screening, fish passage, connectivity, stream flow improvement, etc.) will also provide benefits to overlapping bull trout populations. Likewise, recovery actions in the uppermost portions of these watersheds may be implemented primarily for bull trout (*e.g.*, maintenance of cold water sources, restoration of tributary habitat connectivity and complexity), but these actions ultimately support or are complementary to salmon and steelhead conservation efforts as they help restore and/or maintain high-quality salmon and steelhead habitats downstream.

The recovery costs identified within the remaining core areas or FMO habitat that only contain bull trout (Mid-Snake Geographic Area) are directly attributed to bull trout recovery since no other listed fish species occur within the remaining basins (Powder River, Pine Creek, Indian Creek, Wildhorse Creek). Regardless of whether overlap with anadromous salmon exists, some recovery actions identified may need to be implemented due to other legal and management reasons beyond bull trout recovery implementation. For example, these may include implementation of recovery actions related to obligations under existing section 7 consultations, Superfund restoration actions, Federal Energy Regulatory Commission dam relicensing, National Forest Management Act, Clean Water Act, State regulations, and/or conservation of other aquatic species, etc.).

The implementation schedule includes the following components:

<u>Threat Factor:</u> Listing factor or threat category addressed by the action.

A. The present or threatened destruction, modification or curtailment of bull trout habitat or range;
B. Overutilization for commercial, recreational, scientific, or educational purposes;
C. Disease or predation;
D. The inadequacy of existing regulatory mechanisms; or
E. Other natural or manmade factors affecting its continued existence

<u>Recovery Action Priority</u>:

Priority 1: An action that must be taken to prevent extinction or prevent the species from declining irreversibly in the foreseeable future.

Priority 2: An action that must be taken to prevent a significant decline in species population or habitat quality.

Priority 3: All other actions necessary to meet the recovery objectives.

For reference we also list additional conservation recommendations. These actions are potentially beneficial for bull trout conservation and merit implementation, but they are not considered necessary to meet recovery objectives within a core area and so are not classified as Priority 1, 2, or 3. Conservation recommendations are not included in recovery cost estimates. Conservation recommendations are included in Table C-3 below but are listed separately by core area at the end of the table following actions deemed necessary for recovery.

We evaluate action priorities relative to the core area(s) where the action is targeted. Action priorities may reflect both the severity of the threat and the expected effectiveness of the action in addressing it.

Research, monitoring, and evaluation (RM&E) actions necessary for recovery are those deemed critical for developing information for planning, implementing, monitoring, and evaluating effectiveness of actions addressing management of primary threats. Depending on the level of importance of this information, these RM&E actions may be classified as Priority 1, 2, or 3. Other RM&E actions, while possibly informative and potentially contributing to recovery may not be deemed necessary and will thus be classified as conservation recommendations.

<u>Recovery Action Number and Description</u>: Recovery actions as numbered in the recovery outline. Refer to the Narrative for action descriptions.

<u>Recovery Action Duration</u>: Indicates the number of years estimated to complete the action, or other codes defined as follows:

Continual (C) – An action that will be implemented on a routine basis once begun.

Ongoing (O) – An action that is currently being implemented and will continue until no longer necessary.

To be Determined (TBD) – The action duration is not known at this time or implementation of the action is dependent on the outcome of other recovery actions.

<u>Responsible or Participating Party</u>: Organizations listed are those with responsibility or capability to fund, authorize, or carry out the corresponding recovery tasks. Organizations with broader jurisdiction across multiple core areas are listed first, followed by organizations specific to particular core areas. **Bolded type** indicates the agency or agencies that have the lead role for task implementation and coordination, though not necessarily sole responsibility.

List of Agency Acronyms

ACOE	Army Corp of Engineers
BCC	Boise Cascade Corporation
BLM	U.S. Bureau of Land Management
BOR	Bureau of Reclamation
BPA	Bonneville Power Administration
cities	Cities within the management unit
CD	Conservation Districts
councils	watershed councils
counties	Counties within the management unit
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CTWSR	Confederated Tribes of the Warm Springs Reservation of Oregon
districts	water irrigation districts or companies
EPA	Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
GRMWP	Grande Ronde Model Watershed Program
I	Irrigators
ID	Irrigation districts
IPC	Idaho Power Company
LSRCP	Lower Snake River Compensation Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration Fisheries
NPPC	Northwest Power Planning Council
NPT	Nez Perce Tribe
NRCS	U.S. Natural Resource Conservation Service
ODA	Oregon Department of Agriculture
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
ODSL	Oregon Division of State Lands
ODOT	Oregon Department of Transportation
operators	water diversion and reservoir operators
OSP	Oregon State Police
OWRD	Oregon Water Resources Department
PTC	Private Timber Companies
SRSRB	Snake River Salmon Recovery Board
SWCD	Soil and Water Conservation Districts
TMDLWG	Total Maximum Daily Load Working Group
UPRR	Union Pacific Railroad
USDOT	U.S. Department of Transportation
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

WC	Watershed Councils
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WDOE	Washington Department of Ecology
WDOT	Washington Department of Transportation
WT	Water Trust
Yakama	Yakama Nation

Asotin Core Area

ACCD	Asotin County Conservation District

Clearwater Core Areas

IBODS	Idaho Bureau of Disaster Service
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDL	Idaho Department of Lands
IDWR	Idaho Department of Water Resources
ISCC	Idaho Soil Conservation Commission
ITD	Idaho Department of Transportation

Imnaha Core Area

WVID	Wallowa Valley Irrigation District

North Fork John Day Core Area

M	Miners

Salmo Core Area

KTI	Kalispel Tribe of Indians
SCL	Seattle City Light

Tucannon Core Area

CCD	Columbia Conservation District
FHWA	Federal Highway Administration
GCCD	Garfield County Conservation District
PCD	Pomeroy Conservation District

Walla Walla Core Area

Boise	Boise Corporation, Inc.
WWBWC	Walla Walla Basin Watershed Council
WWRID	Walla Walla River Irrigation District

Table C-3. Mid-Columbia Recovery Unit Implementation Schedule.

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Lower Mid-Columbia Geographic Region													
North Fork John Day	A	2	1.1.1	Restore shade and canopy, riparian cover, and native vegetation in all bull trout spawning, rearing and migration areas.	25	**BLM, NRCS, ODA, ODEQ, USFS**, **CTUIR** CTWSR, SWCD		375	25	25	25	25	25
North Fork John Day	A	2	1.1.2	Identify and reduce sources of excessive fine sediment delivery.	25	**ODF, ODOT, PTC, USDOT**, **CTUIR,** USFS, BLM SWCD, WC	See Watershed Assessments and Travel Management Plans	10,000	500	500	500	500	500
North Fork John Day	A	1	1.1.3	Improve degraded instream conditions associated with legacy mining extraction.	8	**ODEQ, EPA**, **USFS**, **CTUIR,** BLM, NRCS, SWCD	ODEQ lists streams that are water quality limited due to mining effluent & sediment	2,000	250	250	250	250	250
North Fork John Day	A	2	1.1.4	Reduce grazing impacts.	7	BLM**, ODA, NRCS, USFS**, CTUIR CTWSR, SWCD		500	70	70	70	70	70

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
North Fork John Day	A	1	1.2.1	Conduct stream channel and floodplain restoration activities.	15	BLM, **ODFW, USFS**, **CTUIR** BPA, CTWSR, USFWS	*e.g.*, mine tailings and road relocations	2,000	50	50	50	50	50
North Fork John Day	A	2	1.2.2	Minimize impacts of load, placer and suction dredge mining to bull trout and their habitats.	Ongoing	**USFWS, USFS, M**		TBD					
North Fork John Day	A	3	1.2.3	Provide a reliable source of large hardwood beaver forage. Implement activities to encourage riparian shrub and hardwood communities to re-establish in an effort to encourage beaver to naturally recolonize and restore the riverscape. Consider providing large wood support material to jump start beaver dam construction.	15	**USFS**, USFWS, ODFW, NOAA, CTUIR, BPT		TBD					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
North Fork John Day	A	3	1.2.4	Evaluate and implement actions to encourage beaver recolonization. To assist in re-establishing functional riparian communities, Federal, Tribal and State resource agencies should identify and implement measures to increase beaver abundance where feasible and biologically supportable. Reduction in beaver trapping pressures, increase in active releases, and utilization of beaver control structures should be considered where effective and appropriate.	15	**USFS**, USFWS, ODFW, NOAA, CTUIR, BPT		TBD					
North Fork John Day	A	1	2.1.1	Install appropriate fish passage structures around diversions and/or remove migration barriers wherever appropriate.	5	**NOAA, ODFW, SWCD, BOR, USFWS**, **ODOT, USFS**, **CTUIR** NRCS, I		500	100	100	100	100	100
North Fork John Day	A	2	2.1.2	Improve and secure instream flows.	15	**CTUIR, NOAA, ODFW, OWRD, USFWS,** I		1,050	70	70	70	70	70

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
North Fork John Day	A	1	2.1.3	Install appropriate fish screens at diversions irrigation ditches to prevent the entrainment of fish into irrigation systems.	7	**NOAA, ODFW, BOR, USFWS,** I	New and update existing screens	350	50	50	50	50	50
North Fork John Day	A	2	2.1.4	Reduce or eliminate thermal barriers by maintaining or improving riparian vegetation communities providing shade to streams.		**BLM, USFS, CTUIR**		TBD					
North Fork John Day	E	2	3.1.1	Evaluate presence/absence of introduced fishes in bull trout habitat.	5	**ODFW, USFWS**		250	50	50	50	50	50
North Fork John Day	E	2	3.1.2	Assess severity of threat due to hybridization with brook trout where two species co-occur in the North Fork John Day River.	5	**ODFW, USFWS**, USFS		100	20	20	20	20	20
North Fork John Day	E	2	3.1.3	Implement nonnative species removal efforts wherever feasible.	25	**ODFW, USFWS,** USFS CTUIR		300	25	25	25	25	25
North Fork John Day	E	2	4.2.1	Assess current status of resident and migratory bull trout in the North Fork John Day core area.	5	**ODFW, USFWS,** CTUIR		100	20	20	20	20	20
North Fork John Day	E	2	4.2.2	Develop a long term monitoring program to assess status and trend of bull trout in the North Fork John Day Core Area.	2	**ODFW, USFWS,** CTUIR		20	10	10			

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
North Fork John Day	E	2	4.2.3	Identify local populations in the North Fork John Day Core Area.	2	**ODFW, USFWS,** CTUIR		6	3	3			
North Fork John Day	E	2	4.2.4	Further define bull trout distribution and habitat use in the North Fork John Day River Core Area.	5	**ODFW**, USFS, BLM, CTWSR, USFWS, CTUIR		200	40	40	40	40	40
North Fork John Day	E	2	4.3.1	Monitor the distribution of brook trout and hybridization rates within the North Fork John Day basin.	TBD	ODFW, USFWS		TBD					
Middle Fork John Day	A	1	1.1.1	Restore shade and canopy, riparian cover, and native vegetation in all bull trout spawning, rearing and migration areas.	25	BLM**, NRCS, ODA, ODEQ, USFS**, CTWSR, CTUIR SWCD		375	25	25	25	25	25
Middle Fork John Day	A	1	1.1.2	Conduct stream channel and floodplain restoration activities.	15	**ODFW, USFS**, CTWSR, BPA, USFWS CTUIR		2,000	50	50	50	50	50
Middle Fork John Day	A	2	1.1.3	Reduce grazing impacts.	7	BLM**, ODA, NRCS, USFS**, CTUIR CTWSR, SWCD		500	70	70	70	70	70
Middle Fork John Day	A	2	1.1.4	Curtail unauthorized livestock use on USFS property.	TBD	**USFS**		TBD					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Middle Fork John Day	A	2	1.1.5	Improve degraded instream conditions associated with legacy mining and timber extraction.	TBD	**ODFW, USFS, CTWSR, BPA, USFWS, CTUIR**		TBD					
Middle Fork John Day	A	2	1.1.6	Restore the Middle Fork John Day River to a natural channel in the vicinity of Galena within the dredge mine tailings and reconnect Bear Creek to the Middle Fork John Day.	TBD	**ODFW, USFS, CTWSR, BPA, USFWS**		TBD					
Middle Fork John Day	A	2	1.3.1	Implement actions that support The TMDL and Water Quality Management and Restoration plans to achieve water quality objectives.	8	**ODA, ODEQ, EPA**, USFS, BLM, NRCS, ODF, SWCD, CTUIR		2,000	250	250	250	250	250
Middle Fork John Day	A	2	1.3.2	Improve and secure instream flows.	15	**NOAA, ODFW, OWRD, USFWS**, I, CTUIR		1,050	70	70	70	70	70
Middle Fork John Day	A	1	2.1.1	Install appropriate fish passage structures around diversions and/or remove related migration barriers.	5	**NOAA, ODFW, SWCD, USFWS, ODOT, USFS,** NRCS, ID		500	100	100	100	100	100
Middle Fork John Day	A	2	2.1.2	Reduce or eliminate thermal barriers by maintaining or improving riparian vegetation communities providing shade to streams.	TBD	**BLM, NRCS, ODA, ODEQ, USFS, SWCD. CTUIR, CTWSR**		TBD					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Middle Fork John Day	A	2	4.2.1	Assess current status of resident and migratory bull trout in the Middle Fork John Day core area.	5	**ODFW**, USFS, BLM, USFWS		200	40	40	40	40	40
Middle Fork John Day	A	2	4.2.2	Develop a long term monitoring program to assess distribution, status and trend of bull trout in the Middle Fork John Day Core Area.	Ongoing	**USFWS**, ODFW, USFS, CTUIR, CTWSR		TBD					
Middle Fork John Day	A	2	4.2.3	Conduct a genetic analysis to define population and metapopulation structure in the Middle Fork John Day Core Area.	2	**USFWS, USFS**		4	2	2			
Upper Mainstem John Day	A	1	1.1.1	Restore shade and canopy, riparian cover, and native vegetation in all bull trout spawning, rearing and migration areas.	25	**BLM, NRCS, ODA, ODEQ, USFS**, SWCD		375	25	25	25	25	25
Upper Mainstem John Day	A	2	1.1.2	Identify and prioritize opportunities for channel restoration. Design & implement projects.	15	**ODFW, USFS**, CTWSR, BPA, USFWS		2,000	50	50	50	50	50
Upper Mainstem John Day	A	2	1.1.3	Reduce grazing impacts.	7	BLM, **ODA, NRCS, USFS**, CTWSR, SWCD		500	70	70	70	70	70
Upper Mainstem John Day	A	2	1.1.4	Curtail unauthorized livestock use on USFS property.	TBD	**USFS**		TBD					
Upper Mainstem John Day	A	2	1.1.5	Evaluate and implement actions to encourage beaver recolonization.	TBD	**USFS**		TBD					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Upper Mainstem John Day	A	2	1.3.1	Implement actions that support the TMDL and Water Quality Management and Restoration plans to achieve water quality objectives.	8	**ODA, ODEQ, EPA**, USFS, BLM, NRCS, ODF, SWCD		2,000	250	250	250	250	250
Upper Mainstem John Day	A	2	1.3.2	Improve and secure instream flows.	15	**NOAA, ODFW, OWRD, USFWS**, I		1,050	70	70	70	70	70
Upper Mainstem John Day	A	1	2.1.1	Install appropriate fish screens at diversions to prevent the entrainment of fish into irrigation systems.	7	**NOAA, ODFW, BOR, USFWS,** I	New and update existing screens	350	50	50	50	50	50
Upper Mainstem John Day	A	1	2.1.2	Install appropriate fish passage structures around diversions and/or remove related migration barriers.	5	**NOAA, ODFW, SWCD, USFWS, ODOT, USFS,** NRCS, ID		500	100	100	100	100	100
Upper Mainstem John Day	A	2	2.1.3	Identify and remove structures such as log weirs, culverts, and other legacy structures that block juvenile and adult passage to reconnect spawning, rearing and overwinter habitats	TBD	**USFS, SWCD,** BLM, **ODA**		TBD					
Upper Mainstem John Day	A	1	2.1.4	Reduce or eliminate thermal barriers by maintaining or improving riparian vegetation communities providing shade to streams, including non-bull trout bearing streams.	TBD	BLM, **NRCS, ODA, ODEQ, USFS, SWCD**		TBD					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Upper Mainstem John Day	E	2	4.2.1	Assess current status of resident and migratory bull trout in the Upper Mainstem John Day core area.	5	**ODFW**, USFS, BLM, CTWSR, USFWS		200	40	40	40	40	40
Upper Mainstem John Day	E	2	4.2.2	Develop a long term monitoring program to assess distribution, status and trend of bull trout in the Upper Mainstem John Day Core Area.	Ongoing	**USFWS**, ODFW, USFS		TBD					
Upper Mainstem John Day	E	2	4.2.3	Identify local populations in the Upper Mainstem John Day.	2	**USFWS, USFS**		4	2	2			
Umatilla	A	1	1.1.1	Protect and, where needed, revegetate riparian zones in areas used by bull trout.	25	USFS, private landowners, ACOE, All		250					
Umatilla	A	2	1.1.2	Reduce grazing impacts.	25	Landowners, USFS, ODA, CD's, UPRR	Costs unknown	TBD					
Umatilla	A	2	1.1.3	Reduce unauthorized livestock use on National Forest lands by putting greater emphasis on enforcement of livestock grazing regulations.	10	USFWS, USFS		70					
Umatilla	A	1	1.2.1	Restore floodplain function and channel complexity (*e.g.*, sinuosity) in areas utilized by bull trout.	10	Flood Control agencies, ODFW, CTUIR	Includes providing incentives to private landowners.	2,000	200	200	200	200	
Umatilla	A	1	1.2.2	Improve instream habitat complexity.	5	USFS, ODFW, USFWS		200	50	50	50	50	

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Umatilla	A	2	1.2.3	Increase instream flows in areas occupied by bull trout.	25	ID's, ACOE, CTUIR, USFWS, NMFS, ODFW		5,000					
Umatilla	A	2	1.2.4	Reduce, prevent, and minimize development in floodplains.	4	Counties	The Umatilla River from N/S Forks down to Meacham Creek is one area of concern.	50					
Umatilla	A	2	1.2.5	Remedy or reduce impacts of the streamside road on the South Fork Umatilla.	2	USFS		100	50	50			
Umatilla	A	2	1.2.6	Work with Union Pacific Railroad to improve floodplain connectivity, habitat complexity and water quality.	10	UPRR, ODFW, USFWS, CTUIR		5,000					
Umatilla	A	2	1.2.7	Address adverse effects resulting from the county road along the Umatilla River from Meacham Creek to the N/S forks.	2	Umatilla County		150	100	50			
Umatilla	A	2	1.3.1	Pursue opportunities for shade tree development behind flood control dikes (*i.e.*, outside of the channel).	25	Cities, USFWS	cost unknown	TBD					
Umatilla	A	2	1.3.2	Continue to implement the Umatilla River Basin TMDL and Water Quality Management Plan.	5	USFS, ODEQ, TMDLWG Umatilla County		150	50	50	50		

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Umatilla	A	2	2.1.1	Identify and correct the remaining unscreened diversions and pumps that may affect bull trout from the North Fork Umatilla down to the Columbia River.	2	ODFW, CTUIR		100					
Umatilla	A	2	2.1.2	Remedy passage issues at the Feed Canal/Cold Springs Diversion Dam on the Umatilla River.	5	BOR, BPA, Hermiston ID, ODFW	The Westland-Ramos Project	1,000					
Umatilla	A	2	2.1.3	Assess and rectify upstream passage of all life stages of bull trout at all diversion dams on the mainstem Umatilla River.	2	IDs, ODFW, CTUIR		Cost unknown					
Umatilla	A	2	2.1.4	Complete ongoing culvert and other transportation related assessments and implement solutions where barriers affect bull trout.	7	USFS, ODOT, ODF, County		1,100	50	50	200	200	
Umatilla	A	21	2.1.5	Implement stream restoration measures to remedy temperature barriers.	TBD	USFS		*					
Umatilla	E	2	2.3.1	Develop a genetic management plan for the Umatilla Core Area that includes recommended actions for population augmentation and re-introduction.	2	USFWS, ODFW, CTUIR		10					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Umatilla	A	3	4.2.1	Investigate bull trout movement between other lower mid-Columbia core areas and ensure opportunities for connectivity.	5	USFWS, ODFW, CTUIR, ACOE		500	100	100	100	100	
Umatilla	A	2	4.2.2	Develop a long term monitoring program to assess status and trend of bull trout in the Umatilla Core Area.	25	ODFW, UAFWS CTUIR, USFS	Ongoing	500	50	50	50	50	
Umatilla	A	2	4.2.3	Continue maintenance and operation of fish screens on all diversions.	Ongoing	ID, BOR, ACOE. ODFW		*					
Umatilla	E	1	4.3.1	Determine distribution of brook trout in Meacham Creek and eradicate or control as feasible.	2	ODFW, CTUIR		50	25	25			
Walla Walla	A	2	1.1.1	Protect and, where needed, revegetate riparian zones in areas used by bull trout	Ongoing	WDFW, ODFW, CTUIR, City, County, Others		*					
Walla Walla	A	2	1.1.2	Implement measures identified in the Snake River Salmon Recovery Plan.	Ongoing	SRSRB, WDFW, ODFW, CTUIR, City, County, Others	See cost estimates in salmon recovery plan	*					
Walla Walla	A	2	1.2.1	Protect floodplain and riparian function.	15	WDFW, ODFW, USFS, ACOE, Land Trusts	Cost included in task 1.2.2						

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Walla Walla	A	1	1.2.10	Develop and implement a long-term solution to maintain adequate streamflows at and beyond Nursery Bridge.	4	WDOE, USFWS, ID, NOAA	Ongoing	7,500					
Walla Walla	A	2	1.2.11	Investigate groundwater-surface water interactions and implement study recommendations.	5	WWBWC, OWRD, WDOE		250					
Walla Walla	A	2	1.2.12	Explore opportunities for above ground and below ground water storage to improve stream flows.	TBD	WWBWC, OWRD, WDOE, Irrigation Districts	Costs unknown	TBD					
Walla Walla	A	2	1.2.2	Restore riparian and floodplain function including channel structure and complexity in areas used by bull trout.	25	USFS, private landowners, ACOE, Flood Control agencies, WDFW, ODFW, CTUIR All	Includes providing incentives to private landowners	2,250	200	200	200	200	200
Walla Walla	A	2	1.2.3	Pursue opportunities for shade tree development behind flood control dikes (*i.e.*, outside of the channel).	25	Cities, USFWS	Cost included in task 1.2.2						
Walla Walla	A	2	1.2.4	Evaluate and improve the methods used to repair damage resulting from floods.	25	Flood Control agencies, ODFW, WDFW, CTUIR	Ongoing	TBD					
Walla Walla	A	2	1.2.5	Improve instream habitat complexity.	5	USFS, ODFW, WDFW, USFWS, CTUIR		200	50	50	50	50	

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Walla Walla	A	2	1.2.6	Protect flood prone areas from re-development.	4	Counties		50					
Walla Walla	A	2	1.2.7	Evaluate the adequacy of the City of Walla Walla and U.S. Army Corps of Engineers flood control project operations.	5	WW Co., ACOE, MFWCD, ODFW, WDFW,	Mill Creek Working Group is addressing this task.	*					
Walla Walla	A	2	1.2.8	Determine appropriate instream flows in Walla Walla River and Mill Creek.	5	ACOE, USFWS, WDOE, ODFW, WDFW, USFWS, NMFS	IFIM (Instream Flow Incremental Methodology) is one tool.	850	175	175	175	175	175
Walla Walla	A	2	1.2.9	Pursue opportunities to increase instream flows in areas occupied by bull trout.	25	ID's, ACOE, CTUIR, WWBWC, USFWS, NMFS, ODFW, WDFW	Ongoing. COE's flow augmentation feasibility study identifies some opportunities.	5,000					
Walla Walla	A	2	1.3.1	Take corrective actions or otherwise address storm runoff problems (*e.g.*, sediment inputs, waste dumping in storm drains, toxic discharges) in urban areas along the Walla Walla River and Mill Creek	Ongoing	ODEQ, WDOE. Cities, Counties, CD's		TBD					
Walla Walla	A	2	1.3.2	Improve instream habitat complexity.	25	SRSRB, WDFW, ODFW, CTUIR, City, County, Others		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Walla Walla	A	2	2.1.1	Continue to address screening needs on diversions and pumps as they arise and implement projects where necessary and feasible.	8	WDFW, WDOE, ODFW, OWRD		1,500					
Walla Walla	A	2	2.1.10	Maintain and improve passage through the Milton-Freewater flood control system.	TBD	MFWCD	Costs unknown	TBD					
Walla Walla	A	2	2.1.11	Improve passage at the City of Walla Walla Intake upstream fish ladder.	TBD	WDFW, City of Walla Walla	Costs unknown	TBD					
Walla Walla	A	2	2.1.2	At the Bennington Diversion Dam on Mill Creek, implement fish screen improvements or establish flow diversion criteria that ensure bull trout are rarely swept into Bennington Lake.	8	ACOE, WDFW, USFWS, NOAA	$25 million is for an approx. 500 cfs fish screen; current screen handles only 30 cfs	25,000					
Walla Walla	E	2	2.1.3	Establish connectivity between Mill Creek and the Walla Walla River through the Yellowhawk/Mill Creek channel complex and prevent entrainment and stranding.	3	ACOE, WDFW, Walla Walla Co, City of Walla Walla	$200K to fix barriers in Yellowhawk Ck and screen Garrison Ck; much higher cost to fix problems in lower Mill Ck	200	50	50	100		
Walla Walla	A	2	2.1.4	Develop & implement a corrective action (*e.g.*, screens, passage) to address fish stranding problems in the Titus Creek/Ditch.	4	WDFW, WDOE, CD		650	50	200	200	200	

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Walla Walla	A	2	2.1.5	Continue monitoring, maintenance and operation of fish screens on all diversions.	Ongoing	WDFW, ODFW, NMFS, USFWS, ACOE		*					
Walla Walla	A	2	2.1.6	Continue the bull trout salvage program, as needed, until a long-term solution is established.	10	CTUIR, ODFW, WDFW		50					
Walla Walla	A	2	2.1.7	Ensure that the Bennington Diversion Dam fish ladder is adequate for upstream migration.	4	ACOE, WDFW, USFWS		4,000					
Walla Walla	A	2	2.1.8	Modify existing weirs to ensure upstream passage on Mill Creek.	10	ACOE, WDFW, USFWS		2,000	200	200	200	200	
Walla Walla	A	2	2.1.9	Complete ongoing culvert and other transportation related assessments and implement solutions where barriers affect bull trout.	7	USFS, WDNR, ODOT, ODF, Counties		1,100	50	50	200	200	
Walla Walla	C	2	3.1.1	Implement management actions to reduce nonnative fishes where bull trout will benefit and where appropriate.	Ongoing	WDFW, ODFW, NMFS, USFWS		*					
Walla Walla	E	3	3.1.2	Provide information to the public about bull trout identification, special regulations, and habitat needs (including bi-lingual signing).	Ongoing	WDFW, ODFW, NMFS, USFWS		*					
Walla Walla	A	2	4.2.1	Continue long term monitoring program to assess status and trend of bull trout in the Walla Walla Core Area.	Ongoing	ODFW, WDFW, CTUIR, USFS		250	10	10	10	10	10

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Walla Walla	B	3	4.2.2	Evaluate incidental and illegal harvest of bull trout.	1	ODFW, WDFW, USFWS, CTUIR		25	25				
Walla Walla	A	3	4.3.1	Assess distribution of brook trout in Big Spring Branch of the East Little Walla Walla and other Spring Branches of the Walla Walla River and evaluate the need for control.	2	ODFW, USFWS, CTUIR		50	25	25			
Walla Walla	A	3	5.1.1	Continue implementation of NRCS conservation programs targeting the reduction of sediment and nutrient inputs into Mill Creek and North and South Forks of the Walla Walla River.	5	USFS, BLM, NRCS, ODEQ, Boise, Counties, WWBWC		100	20	20	20	20	20
Walla Walla	A	2	5.1.2	Continue to implement the Walla Walla TMDL and Water Quality Implementation Plan to address non-point source pollution.	25	ODEQ, WDOE, WWBWC, TMDLWG		*					
Touchet	A	2	1.1.1	Protect and, where needed, revegetate riparian zones in areas used by bull trout.	Ongoing	WDFW, CTUIR, City, County, Others		*					
Touchet	A	2	1.1.2	Implement measures identified in the Snake River Salmon Recovery Plan.	Ongoing	SRSRB, WDFW, CTUIR, City, County, Others		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Touchet	A	2	1.1.3	Protect floodplain and riparian function.	15	WDFW, USFS, CTUIR, Others	Cost included in task 1.2.4						
Touchet	A	2	1.2.1	Pursue opportunities for shade tree development behind flood control dikes	Ongoing	Cities, ACOE, USFWS		*					
Touchet	A	2	1.2.2	Reduce, prevent, and minimize development in floodplains	Ongoing	Cities, Counties, ACOE,		*					
Touchet	A	2	1.2.3	Evaluate and improve the methods used to repair damage resulting from floods.	Ongoing	Cities, Counties, ACOE		*					
Touchet	A	1	1.2.4	Pursue opportunities to restore floodplain function and channel complexity (*e.g.*, sinuosity) in areas utilized by bull trout.	Ongoing	ACOE, CTUIR, Cities, Counties, WDFW		2200	200	200	200	200	200
Touchet	A	1	1.2.5	Improve instream habitat through wood recruitment.	5	USFS, WDFW, USFWS		250	50	50	50	50	50
Touchet	A	2	1.2.7	Address road issues in the upper Touchet River Basin.	3	USFS, County, WDOT		600	200	200	200		
Touchet	A	2	1.2.8	Evaluate alternative access across river for cabin owners in the upper South Fork Touchet River.	10	USFS, County, WDOT		*					
Touchet	A	2	1.3.1	Develop and implement comprehensive livestock grazing management plans.	Ongoing	Landowners, USFS, WSDA, WDOE, CCD		*					
Touchet	A	2	1.3.2	Take corrective actions or otherwise address storm runoff problem.	Ongoing	WDOE, Cities, Counties, WDOT		*					
Touchet	A	1	2.1.1	Improve passage at Dayton Steelhead Acclimation Pond Dam for bull trout.	3	LSRCP, NMFS, WDFW		800	400	200	200		

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Touchet	A	1	2.1.2	Monitor and repair screens throughout basin.	Ongoing	WDFW, NMFS, WDOE		*					
Touchet	A	1	2.1.3	Assess and remove permanent and seasonal barriers to bull trout migration.	Ongoing	WDFW, NMFS, USFS		*					
Touchet	C	2	3.1.1	Design and implement an educational effort about the problems and consequences of unauthorized fish introductions.	Ongoing	WDFW, USFWS		*					
Touchet	C	2	3.1.2	Implement management actions to reduce nonnative fishes where bull trout will benefit and where appropriate.	Ongoing	WDFW, USFWS		*					
Touchet	E	3	3.1.3	Provide information to the public about bull trout identification, special regulations, and habitat needs (including bi-lingual signing).	Ongoing	WDFW, USFS, USFWS		*					
Touchet	A	2	4.2.1	Further define bull trout distribution and habitat use in the core area.	C	WDFW, USFWS, CTUIR, USFS		*					
Touchet	A	2	4.2.2	Continue ongoing population monitoring efforts within the basin.	C	WDFW, USFWS, CTUIR, USFS		*					
Touchet	A	2	4.2.3	Continue maintenance and operation of fish screens on all diversions.	Ongoing	WDFW, NMFS, WDOE		*					
Estimated cost subtotal, Lower Mid-Columbia Geographic Region: $102,464,000 (over 25 years, minimum estimate)													
Upper Mid-Columbia Geographic Region													
Salmo	A	2	1.1.1	Complete watershed action plan.	4	**British Columbia**, USFS, USFWS, KTI, SCL, WDFW	Costs unknown, Canadian led effort	TBD					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Salmo	A	2	1.1.2	Improve riparian and instream habitat.	Ongoing	**British Columbia**, USFS, USFWS, KTI, WDFW	Costs unknown, Canadian led effort	TBD					
Salmo	A	2	2.1.1	Assess and remove barriers.	Ongoing	**British Columbia**, USFS, USFWS, KTI, WDFW	Costs unknown, Canadian led effort	TBD					
Salmo	D	2	2.2.1	Increase enforcement of fishing regulations (Canada).	Ongoing	**British Columbia**	Costs unknown, Canadian led effort	TBD					
Salmo	C	2	3.1.1	Suppress non-native populations.	Ongoing	**British Columbia**, USFS, USFWS, KTI	Costs unknown, Canadian led effort	TBD					
Salmo	C	2	3.1.2	Reduce entrainment of non-native predatory species such as pike, bass, and walleye at Boundary Dam.	Ongoing	SCL, British Columbia,	Costs unknown	TBD					
Salmo	A	2	4..1	Monitor and assess South Fork population.	C	**British Columbia**, USFS, USFWS, KTI, SCL, WDFW		*					
Salmo	A	2	4.1.2	Research extent of the use of the Pend Oreille River FMO.	C	**British Columbia**, USFS, USFWS, KTI, SCL, WDFW		*					
Okanogan FMO	A	3	1.1.1	Protect and improve riparian areas.	O	WDFW, County, NRCS, USFWS, PUDs, BPA	Combined with salmon recovery	1,000					
Okanogan FMO	A	3	1.1.2	Maintain, restore, and protect riparian zones.	O	USFS, WDNR, WDFW, PTC,		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Okanogan FMO	A	2	1.1.3	Reduce grazing impacts.	O	USFS, WDNR, County, Consv Dist,		300					
Okanogan FMO	A	3	1.1.4	Reduce impacts to riparian areas and stream banks.	O	WDFW, DOE, USCOE, County, Cities, Cons Dist,	Combined with salmon recovery	1,000					
Okanogan FMO	A	2	1.1.5	Reduce floodplain impacts.	C	USFS, WDNR, WDFW, Pvt Rec Groups,		500					
Okanogan FMO	A	3	1.2.1	Implement stream restoration in degraded stream reaches.	O	USFS, WDNR, PTC, Colville Tribe, BPA, PUDs	Combined with salmon recovery	1,000					
Okanogan FMO	A	1	1.2.2	Develop adequate passage to connect Okanogan and Columbia R FMO habitat.	O	PUDs, USFS, WDNR, Cons Dist, NRCS,		1,000					
Okanogan FMO	A	1	1.2.3	Connect FMO and spawning and rearing habitat.	5-20	PUDs, WDFW, Colville Tribe, USFWS, NOAA, BPA		1,000					
Okanogan FMO	A	2	1.2.4	Reduce impacts to adjacent instream habitat and remove passage barriers.	10	Fed Hwys, WADOT, WDFW, USFS USFWS, NOAA	Combined with salmon recovery	700					
Okanogan FMO	A	2	1.2.5	Secure appropriate instream flows to move towards natural regimes.	C	WDOE, BOR, PUDs, USFWS, NOAA, Colville Tribe,	Combined with salmon recovery	*					
Okanogan FMO	D	2	1.2.6	Meet instream water quality standards.	C	WDOE, EPA, BOR, COE, PUDs, USFS		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Okanogan FMO	E	2	1.2.7	Improve habitat complexity, water quality, and connectivity.	C	WDOE, EPA, PUDs, WDFW, USFS, WDNR, Colville Tribe	Combined with salmon recovery Also See 1.2.5	1,000					
Okanogan FMO	A	1	2.1.1	Improve connectivity at diversions and improve water quality.	5-10	WDFW, BOR, Irrig. Dist, USFWS, NOAA	Combined with salmon recovery	100					
Okanogan FMO	A	2	2.1.2	Improve, maintain, and decommission forest roads.	O	USFS, WDNR, PTC, Colville Tribe		1,000					
Okanogan FMO	A	1	2.1.3	Reduce entrainment.	5-20	USFWS, PUDs, WDFW, Irrig Dists		1,000					
Okanogan FMO	A	1	2.1.4	Improve fish passage at all dams, smaller diversion, and at road crossings.	20	BPA, COE, PUDs, USFS, Colville Tribe	Also see 2.1.1						
Okanogan FMO	A	2	2.1.5	Reduce impacts from transportation networks.	10	WADOT, Fed Hwys, County,	Combined w/ salmon recovery	500					
Okanogan FMO	A	2	2.1.6	Maintain/improve cool water refuge, water quality, and flows for movement.	C	PUD, BPA, BOR, COE, WDFW	Also see 1.1.1, 1.2.1, 1.2.5						
Okanogan FMO	B, E	3	2.2.1	Reduce incidental catch.	C	WDFW, Fishing guides, USFWS		250					
Okanogan FMO	E	3	2.2.2	Continue to consider stocking of native species and reduction of non-native brook trout and other salmonids.	O	WDFW, Colville Tribe		*					
Okanogan FMO	E	1	2.2.3	Reduce impacts from incidental catch from other fisheries monitoring activities.	C	WDFW, PUDs NOAA, Colville Tribe, USFWS		250					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Okanogan FMO	A	1	2.3.1	Improve migratory life history connectivity.	5-20	PUDs, BPA, BOR COE, USFS, WDNR,	See 1.2.5	TBD					
Okanogan FMO	E	3	2.3.2	Reduce potential for negative species interactions.	O	NOAA, PUDs, USFWS, WDFW		TBD					
Okanogan FMO	All	3	2.4.1	Improve forage fish opportunities.	O	WDFW, BOR, BPA, USFWS, NOAA, Colville Tribe	See 1.2.5 and 2.1.4, and combined with salmon recovery	*					
Okanogan FMO	B, C	3	2.4.2	Reduce numbers of introduced species.	C	WDFW, USFS, USFWS, NOAA		3,000					
Okanogan FMO	D, E	2	2.4.3	Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages.	5-10	WDFW, Colville Tribe, USFWS, NOAA, BPA, PUDs	Combined with salmon recovery	50					
Okanogan FMO	B, C	1	3.1.1	Reduce numbers of introduced/non-native species.	O	WDFW, Colville Tribe, USFWS, NOAA, BPA, BOR, COE, USFS, WDNR	See 2.4.2	*					
Okanogan FMO	B	3	3.1.2	Conduct fisheries management to reduce impacts on bull trout.	C	All		*					
Okanogan FMO	All	1	3.1.3	Plan for and reduce potential for increased non-native competition.	C	WDFW, USFWS		*					
Okanogan FMO	A	1	4.1.1	Develop information for action plan. Evaluate habitat conditions and determine bull trout potential. Include patch analysis, etc.	5	USGS, WDFW, USFS, USFWS, PUDs	Combined with similar work in other basins	300					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Okanogan FMO	A	3	4.1.2	Monitor FMO habitat conditions for climate change.	O	WDNR, USFS, Pvt Land, Irrig. Dist,		100					
Okanogan FMO	A, D	2	4.1.3	Evaluate irrigation diversion screens.	O	WDNR, USFS, Pvt Land, Irrig. Dist,		TBD					
Okanogan FMO	D, E	1	4.1.4	Develop brook eradication and monitoring plan.	5	WDFW, USFS, USFWS, NOAA, Colville Tribe,		50					
Okanogan FMO	E	1	4.2.1	Develop an action plan for population information and develop a plan to survey for presence of resident and migratory bull trout.	5	WDFW, USFWS	other core areas	500					
Okanogan FMO	D, E	1	4.2.2	Determine impacts of incidental catch in other catch fisheries.	O	WDFW, USFWS		50					
Okanogan FMO	E	2	4.2.3	Develop food web and predator prey analysis.	5	WDFW, USFWS, USFS, USFS, PUDs		300					
Okanogan FMO	C, D, E	2	4.3.1	Determine distribution of brook trout.	5	WDFW, CWU, USGS, Colville Tribe		300					
Okanogan FMO	A	2	1.2.5	Secure appropriate instream flows to move towards natural regimes.	C	WDOE, BOR, PUDs, USFWS, NOAA, Colville Tribe,	Combined with salmon recovery	*					
Chelan Historic Core Area and FMO Habitat	A	3	1.1.1	Maintain, restore, and protect riparian areas.	O	WDFW, County, NRCS, USFWS, PUDs, BPA	Combined with salmon recovery	1,000					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Chelan Historic Core Area and FMO Habitat	A	3	1.1.2	Maintain, restore, and protect riparian zones.	O	USFS, WDNR, WDFW, PTC		*					
Chelan Historic Core Area and FMO Habitat	A	3	1.1.3	Reduce grazing impacts.	O	USFS, WDNR, County, Cons Dist,		300					
Chelan Historic Core Area and FMO Habitat	A	3	1.1.4	Reduce impacts to riparian areas and stream banks.	O	WDFW, DOE, USCOE, County, Cities, Cons Dist,	Combined with salmon recovery	1,000					
Chelan Historic Core Area and FMO Habitat	A	3	1.1.5	Reduce impacts from recreation to riparian areas.	C	USFS, WDNR, WDFW, Pvt Rec Groups,		500					
Chelan Historic Core Area and FMO Habitat	A	3	1.2.1	Reduce impacts to water quality.	O	WDFW, NRCS, Cons Dist, County	Combined with salmon recovery	1,000					
Chelan Historic Core Area and FMO Habitat	A	3	1.2.2	Implement stream restoration in degraded stream reaches.	O	USFS, WDNR, PTC, Yakama, BPA, PUDs	Combined with salmon recovery	1,000					
Chelan Historic Core Area and FMO Habitat	A	3	1.2.3	Develop adequate passage to connect FMO to spawning and rearing habitat.	O	PUDs, USFS, WDNR, Cons Dist, NRCS,		1,000					
Chelan Historic Core Area and FMO Habitat	A	3	1.2.4	Connect lake and river habitat.	5-20	PUDs, WDFW, Yakama, USFWS, NOAA, BPA		1,000					
Chelan Historic Core Area and FMO Habitat	A	3	1.2.5	Reduce impacts to adjacent instream habitat and remove passage barriers.	10	Fed Hwys, WADOT, WDFW, USFS USFWS, NOAA	Combined with salmon recovery	700					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Chelan Historic Core Area and FMO Habitat	A	3	1.2.6	Move towards more natural lake levels and flow regimes.	C	WDOE, BOR, PUDs, USFWS, NOAA, Yakama	Combined with salmon recovery	*					
Chelan Historic Core Area and FMO Habitat	D	3	1.2.7	Meet instream water quality standards.	C	WDOE, EPA, BOR, COE, PUDs, USFS		*					
Chelan Historic Core Area and FMO Habitat	E	3	1.2.8	Improve habitat complexity in lake and tributaries, and Chelan River.	C	WDOE, EPA, PUDs, WDFW, USFS, WDNR, Yakama,	Combined with salmon recovery Also See 1.2.5	1,000					
Chelan Historic Core Area and FMO Habitat	A	3	2.1.1	Improve connectivity at diversions and improve water quality.	5-10	WDFW, BOR, Irrig. Dist, USFWS, NOAA	Combined with salmon recovery	100					
Chelan Historic Core Area and FMO Habitat	A	3	2.1.2	Improve, maintain, and decommission, forest roads.	O	USFS, WDNR, PTC, Yakama		1,000					
Chelan Historic Core Area and FMO Habitat	A	3	2.1.3	Reduce entrainment.	5-20	USFWS, PUDs, WDFW, Irrig Dists		1,000					
Chelan Historic Core Area and FMO Habitat	A	3	2.1.4	Reduce impacts from transportation networks.	10	WADOT, Fed Hwys, County	Combined w/ salmon recovery	500					
Chelan Historic Core Area and FMO Habitat	A	3	2.1.5	Improve reservoir levels and flows in Chelan River.	C	PUD, BPA, BOR, COE, WDFW		TBD					
Chelan Historic Core Area and FMO Habitat	A	3	2.1.6	Maintain and improve connectivity to Lake Chelan and river as possible.	C	PUDs, BPA, BOR, COE, WDNR, WDOE, EPA		500					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000) Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Chelan Historic Core Area and FMO Habitat	B, E	3	2.2.1	Reduce incidental catch and poaching.	C	WDFW, Fishing guides, USFWS		250					
Chelan Historic Core Area and FMO Habitat	E	3	2.2.2	Continue to consider stocking of native species a priority.	O	WDFW		*					
Chelan Historic Core Area and FMO Habitat	E	3	2.2.3	Reduce impacts from incidental catch from other fisheries monitoring activities.	C	WDFW, PUDs NOAA, Yakama, USFWS		250					
Chelan Historic Core Area and FMO Habitat	A	3	2.3.1	Improve migratory life history connectivity for native fish/bull trout in lake and river.	5-20	PUDs, BPA, BOR COE, USFS, WDNR	See 1.2.5	TBD					
Chelan Historic Core Area and FMO Habitat	E	3	2.3.2	Reduce potential for negative species interactions in populations with low abundances.	O	NOAA, PUDs, USFWS, WDFW		*					
Chelan Historic Core Area and FMO Habitat	All	3	2.4.1	Improve forage fish opportunities.	O	WDFW, BOR, BPA, USFWS, NOAA, Yakama	See 1.2.5 and 2.1.4, and combined with salmon recovery	*					
Chelan Historic Core Area and FMO Habitat	B, C	3	2.4.2	Reduce numbers of introduced species.	C	WDFW, USFS, USFWS, NOAA		3,000					
Chelan Historic Core Area and FMO Habitat	D, E	3	2.4.3	Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages.	5-10	WDFW, Yakama, USFWS, NOAA, BPA, PUDs	Combined with salmon recovery	50					
Chelan Historic Core Area and FMO Habitat	B, C	3	3.1.1	Reduce numbers of introduced/non-native species.	O	WDFW, Yakama, USFWS, NOAA, BPA, BOR, COE, USFS, WDNR	See 2.4.2	*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000) Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Chelan Historic Core Area and FMO Habitat	B	3	3.1.2	Conduct fisheries management to reduce impacts on bull trout.	C	All		*					
Chelan Historic Core Area and FMO Habitat	All	3	3.1.3	Plan for and reduce potential for increased non-native competition.	C	WDFW, USFWS		*					
Chelan Historic Core Area and FMO Habitat	A	1	4.1.1	Develop Information for action plan. Evaluate habitat conditions and determine bull trout potential. Include patch analysis, etc.	5	USGS, WDFW, USFS, USFWS, PUDs	Combined with similar work in other basins	300					
Chelan Historic Core Area and FMO Habitat	A	3	4.1.2	Monitor native species habitat.	O	WDNR, USFS, Pvt Land, Irrig. Dist		100					
Chelan Historic Core Area and FMO Habitat	D, E	2	4.1.3	Develop brook and lake trout eradication and monitoring plan.	5	WDFW, USFS, USFWS, NOAA, Yakama		50					
Chelan Historic Core Area and FMO Habitat	E	1	4.1.4	Research to understand the entrainment of native species at Chelan Dam and Power house.	O	WDFW, USFWS		50					
Chelan Historic Core Area and FMO Habitat	E	2	4.2.1	Develop an action plan to assess and survey for presence of resident and migratory bull trout.	5	WDFW, USFWS	other core areas	500					
Chelan Historic Core Area and FMO Habitat	D, E	1	4.2.2	Determine impacts of incidental catch in other catch fisheries.	O	WDFW, USFWS		50					
Chelan Historic Core Area and FMO Habitat	D, E	2	4.2.3	Determine level of poaching.	5	WDFW, USFWS, NOAA		30					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Chelan Historic Core Area and FMO Habitat	E	2	4.2.4	Develop food web and predator prey analysis.	5	WDFW, USFWS, USFS, USFS, PUDs		300					
Chelan Historic Core Area and FMO	C, D, E	3	4.3.1	Determine distribution of brook, lake, and brown trout.	5	WDFW, CWU, USGS, Yakama		300					
Methow	A	2	1.1.1	Maintain, restore, and protect riparian areas.	O	WDFW, County, NRCS, USFWS, PUDs, BPA	Combined with salmon recovery	1,000					
Methow	A	1	1.1.2	Maintain, restore, and protect riparian zones.	O	USFS, WDNR, WDFW, PTC		*					
Methow	A	1	1.1.3	Reduce grazing impacts.	O	USFS, WDNR, County, Cons Dist,		300					
Methow	A	2	1.1.4	Reduce impacts to riparian areas and stream banks from urbanization.	O	WDFW, DOE, USCOE, County, Cities, Cons Dist	Combined with salmon recovery	1,000					
Methow	A	1	1.1.5	Reduce habitat and floodplain impacts.	O	WSDOT, Fed Hwys, County	Combined w/ salmon recovery	3,000					
Methow	A	1	1.1.6	Reduce impacts from recreation to riparian areas.	C	USFS, WDNR, WDFW, State Parks and Rec, Pvt Rec Groups		5,000					
Methow	A	2	1.2.1	Protect and improve riparian areas and floodplains.	O	WDFW, NRCS, Cons Dist, County	Combined with salmon recovery	1,000					
Methow	A	2	1.2.2	Implement stream restoration in degraded stream reaches.	O	USFS, WDNR, PTC, Yakama, BPA, PUDs	Combined with salmon recovery	15,000					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Methow	A	2	1.2.3	Reduce impacts from management to populations already impacted by dewatering.	C	BOR, USFS, WSDOT, Irrig Districts, WDNR		*					
Methow	A	1	1.2.4	Develop adequate passage to connect FMO to spawning and rearing habitat.	O	PUDs, USFS, WDNR, Cons Dist, NRCS		1,000					
Methow	A	1	1.2.5	Connect FMO to spawning and rearing habitat.	5-20	PUDs, WDFW, Yakama, USFWS, NOAA, BPA		1,000					
Methow	A	1	1.2.6	Reduce impacts from development.	C	WDFW, County, Cities, Cons Dists, Ski Areas, USFS	Combined with salmon recovery	*					
Methow	A	1	1.2.7	Reduce impacts to adjacent instream habitat and remove passage barriers.	10	Fed Hwys, WADOT, WDFW, USFS USFWS, NOAA	Combined with salmon recovery	2,000					
Methow	A	1	1.2.8	Secure appropriate instream flows and move towards more natural flow regimes.	C	WDOE, BOR, PUDs, USFWS, NOAA, Yakama	Combined with salmon recovery	*					
Methow	D	1	1.2.9	Meet instream water quality standards.	C	WDOE, EPA, BOR, COE, PUDs, USFS		*					
Methow	E	2	1.2.10	Improve habitat complexity, water quality, and connectivity.	C	WDOE, EPA, PUDs, WDFW, USFS, WDNR, Yakama	Combined with salmon recovery Also See 1.2.5	1,000					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Methow	A	1	2.1.1	Improve connectivity at diversions and improve water quality.	5-10	WDFW, BOR, Irrig. Dist, USFWS, NOAA	Combined with salmon recovery	1,000					
Methow	A	1	2.1.2	Improve, maintain, and decommission, forest roads.	O	USFS, WDNR, PTC, Yakama		1,000					
Methow	A	2	2.1.3	Reduce management to improve access and timing of use (*i.e.*, reduce delay to spawning areas).	C	USFS, WDNR, BOR, County, Cities		*					
Methow	A	1	2.1.4	Reduce entrainment.	5-20	USFWS, PUDs, WDFW, Irrig Dists		1,600					
Methow	A	1	2.1.5	Improve fish passage at all dams, diversions, and road crossings.	5-20	PUDs, WDFW, USFS, WDNR, PTC, Irrig Dists	See Also 1.2.5 & 2.1.2						
Methow	A	1	2.1.6	Reduce impacts from transportation networks.	10	WADOT, Fed Hwys, County	Combined w/ salmon recovery	5,000					
Methow	A	2	2.1.7	Improve stream flows to a more normative pattern.	5	BOR, WDFW, WDOE, USFWS, NOAA, Yakama, Irrig Dists		3,000					
Methow	A	3	2.1.8	Maintain and improve cool water refuge, water quality and instream flows.	C	PUDs, BPA, BOR, COE, WDNR, WDOE, EPA		1,000					
Methow	B, E	1	2.2.1	Reduce incidental catch and poaching (*i.e.*, Lost River)	C	WDFW, Fishing guides, USFWS		500					
Methow	E	1	2.2.2	Continue to consider stocking of native species a priority.	O	WDFW		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Methow	E	2	2.2.3	Reduce impacts from incidental catch from other fisheries monitoring activities.	C	WDFW, PUDs NOAA, Yakama, USFWS		300					
Methow	All	1	2.3.1	Improve genetic and demographic stochasticity.	O	All	Will do this with all actions	*					
Methow	A	1	2.3.2	Improve migratory life history connectivity.	5-20	PUDs, BPA, BOR COE, USFS, WDNR,	See 1.2.5	TBD					
Methow	E	1	2.3.3	Reduce potential for negative species interactions in populations with low abundances.	O	NOAA, PUDs, USFWS, WDFW		*					
Methow	All	2	2.4.1	Improve forage fish opportunities.	O	WDFW, BOR, BPA, USFWS, NOAA, Yakama	See 1.2.5 and 2.1.4, and combined with salmon recovery	*					
Methow	B, C	1	2.4.2	Reduce numbers of introduced species.	C	WDFW, USFS, USFWS, NOAA		300					
Methow	D, E	1	2.4.3	Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages.	5-10	WDFW, Yakama, USFWS, NOAA, BPA, PUDs	Combined with salmon recovery	50					
Methow	B, C	1	3.1.1	Reduce numbers of introduced/non-native species.	O	WDFW, Yakama, USFWS, NOAA, BPA, BOR, COE, USFS, WDNR	See 2.4.2	*					
Methow	B	1	3.1.2	Conduct fisheries management to reduce impacts on bull trout.	C	All		*					
Methow	All	1	3.1.3	Plan for and reduce potential for increased non-native competition.	C	WDFW, USFWS		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Methow	A	2	4.1.1	Develop information for action plan. Evaluate habitat conditions and determine bull trout potential. Include patch analysis, etc.	5	USGS, WDFW, USFS, USFWS, PUDs	Combined with similar work in other basins	300					
Methow	A, E	2	4.1.2	Continue to monitor key bull trout habitat with temperature probes.	O	USFS, Yakama, BPA, WDFW, WDNR		200					
Methow	D	1	4.1.3	Evaluate irrigation diversion screens for bull trout.	5	WDFW		*					
Methow	A	3	4.1.4	Evaluate natural dewatering water areas.	O	WDNR, USFS, Pvt Land, Irrig. Dist		100					
Methow	D, E	1	4.1.5	Develop brook trout eradication and monitoring plan.	5	WDFW, USFS, USFWS, NOAA, Yakama		50					
Methow	E	2	4.2.1	Develop an action plan to inform and assess current status of resident and migratory bull trout.	O	WDFW, USFWS		250					
Methow	E	2	4.2.2	Develop long term monitoring program to assess distribution, status, and trend.	5	WDFW, USFWS	other core areas	1,000					
Methow	D, E	2	4.2.3	Determine impacts of incidental catch in other catch fisheries.	O	WDFW, USFWS		50					
Methow	D, E	1	4.2.4	Determine level of poaching.	5	WDFW, USFWS, NOAA		30					
Methow	E	1	4.2.5	Develop food web and predator prey analysis.	5	WDFW, USFWS, USFS, USFS, PUDs		300					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Methow	C, D, E	2	4.3.1	Determine distribution of brook, lake, and brown trout.	5	WDFW, CWU, USGS, Yakama		30					
Entiat	A	1	1.1.1	Maintain, restore, and protect riparian areas.	O	WDFW, County, NRCS, USFWS, PUDs, BPA	Combined with salmon recovery	1,000					
Entiat	A	1	1.1.2	Maintain, restore, and protect riparian zones.	O	USFS, WDNR, WDFW, PTC		*					
Entiat	A	2	1.1.3	Reduce grazing impacts.	O	USFS, WDNR, County, Cons Dist,		300					
Entiat	A	2	1.1.4	Reduce impacts to riparian areas, stream banks, stream flow, and water quality.	O	WDFW, DOE, USCOE, County, Cities, Cons Dist	Combined with salmon recovery	2,000					
Entiat	A	1	1.1.5	Reduce habitat and floodplain impacts.	O	WSDOT, Fed Hwys, County	Combined w/ salmon recovery	2,000					
Entiat	A	2	1.1.6	Reduce impacts from recreation to riparian areas.	C	USFS, WDNR, WDFW, Pvt Rec Groups		500					
Entiat	A	2	1.2.1	Protect and improve riparian areas and floodplains.	O	WDFW, NRCS, Cons Dist, County	Combined with salmon recovery	1,000					
Entiat	A	2	1.2.2	Implement stream restoration in degraded stream reaches.	O	USFS, WDNR, PTC, Yakama, BPA, PUDs	Combined with salmon recovery	1,000					
Entiat	A	1	1.2.3	Develop adequate passage to connect FMO to spawning and rearing habitat.	O	PUDs, USFS, WDNR, Cons Dist, NRCS,		1,000					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000) Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Entiat	A	1	1.2.4	Connect FMO to spawning and rearing habitat.	5-20	PUDs, WDFW, Yakama, USFWS, NOAA, BPA		1,000					
Entiat	A	1	1.2.5	Reduce impacts from development.	C	WDFW, County, Cities, Cons Dists, Ski Areas, USFS	Combined with salmon recovery	*					
Entiat	A	1	1.2.6	Reduce impacts to adjacent instream habitat and remove passage barriers.	10	Fed Hwys, WADOT, WDFW, USFS USFWS, NOAA	Combined with salmon recovery	1,000					
Entiat	A	1	1.2.7	Secure appropriate instream flows and move towards more natural flow regimes.	C	WDOE, BOR, PUDs, USFWS, NOAA, Yakama,	Combined with salmon recovery	*					
Entiat	D	1	1.2.8	Meet instream water quality standards.	C	WDOE, EPA, BOR, COE, PUDs, USFS		*					
Entiat	E	1	1.2.9	Improve habitat complexity, water quality, and connectivity.	C	WDOE, EPA, PUDs, WDFW, USFS, WDNR, Yakama	Combined with salmon recovery Also See 1.2.5	1,000					
Entiat	A	2	2.1.1	Improve connectivity at diversions and improve water quality.	5-10	WDFW, BOR, Irrig. Dist, USFWS, NOAA	Combined with salmon recovery	500					
Entiat	A	1	2.1.2	Improve, maintain, and decommission, forest roads.	O	USFS, WDNR, PTC, Yakama		3,000					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Entiat	A	1	2.1.3	Reduce entrainment.	5-20	USFWS, PUDs, WDFW, Irrig Dists		1,600					
Entiat	A	1	2.1.4	Improve fish passage at all dams, diversions, and road crossings.	5-20	PUDs, WDFW, USFS, WDNR, PTC, ID	See Also 1.2.5 & 2.1.2						
Entiat	A	1	2.1.5	Reduce impacts from transportation networks.	10	WADOT, Fed Hwys, County,	Combined w/ salmon recovery	500					
Entiat	A	2	2.1.6	Maintain and improve cool water refuge, water quality and instream flows.	C	PUDs, BPA, BOR, COE, WDNR, WDOE, EPA		500					
Entiat	B, E	1	2.2.1	Reduce incidental catch and poaching.	C	WDFW, Fishing guides, USFWS		250					
Entiat	E	3	2.2.2	Continue to consider stocking of native species a priority.	O	WDFW		*					
Entiat	E	1	2.2.3	Reduce impacts from incidental catch from other fisheries monitoring activities.	C	WDFW, PUDs NOAA, Yakama, USFWS		250					
Entiat	All	2	2.3.1	Improve genetic and demographic stochasticity.	O	All	Will do this with all actions	*					
Entiat	A	1	2.3.2	Improve migratory life history connectivity.	5-20	PUDs, BPA, BOR COE, USFS, WDNR,	See 1.2.5						
Entiat	E	1	2.3.3	Reduce potential for negative species interactions in populations with low abundances.	O	NOAA, PUDs, USFWS, WDFW		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000) Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Entiat	All	3	2.4.1	Improve forage fish opportunities.	O	WDFW, BOR, BPA, USFWS, NOAA, Yakama	See 1.2.5 and 2.1.4, and combined with salmon recovery	*					
Entiat	B, C	2	2.4.2	Reduce numbers of introduced species.	C	WDFW, USFS, USFWS, NOAA		300					
Entiat	D, E	2	2.4.3	Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages.	5-10	WDFW, Yakama, USFWS, NOAA, BPA, PUDs	Combined with salmon recovery	50					
Entiat	B, C	2	3.1.1	Reduce numbers of introduced/non-native species.	O	WDFW, Yakama, USFWS, NOAA, BPA, BOR, COE, USFS, WDNR	See 2.4.2	*					
Entiat	B	1	3.1.2	Conduct fisheries management to reduce impacts on bull trout.	C	All		*					
Entiat	All	2	3.1.3	Plan for and reduce potential for increased non-native competition.	C	WDFW, USFWS		*					
Entiat	A	2	4.1.1	Develop information for action plan. Evaluate habitat conditions and determine bull trout potential. Include patch analysis, etc.	5	USGS, WDFW, USFS, USFWS, PUDs	Combined with similar work in other basins	300					
Entiat	A, E	2	4.1.2	Continue to monitor key bull trout habitat with temperature probes.	O	USFS, Yakama, BPA, WDFW, WDNR		500					
Entiat	D	1	4.1.3	Evaluate irrigation diversion screens for bull trout.	5	WDFW		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000) Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Entiat	A	3	4.1.4	Evaluate low water areas.	O	WDNR, USFS, Pvt Land, Irrig. Dist		100					
Entiat	D, E	1	4.1.5	Develop brook trout eradication and monitoring plan.	5	WDFW, USFS, USFWS, NOAA, Yakama		50					
Entiat	E	2	4.2.1	Develop an action plan to inform and assess current status of resident and migratory bull trout.	O	WDFW, USFWS		50					
Entiat	E	3	4.2.2	Develop long term monitoring program to assess distribution, status, and trend.	5	WDFW, USFWS	other core areas	1,000					
Entiat	D, E	2	4.2.3	Determine impacts of incidental catch in other catch fisheries.	O	WDFW, USFWS		50					
Entiat	D, E	2	4.2.4	Determine level of poaching.	5	WDFW, USFWS, NOAA		30					
Entiat	E	2	4.2.5	Develop food web and predator prey analysis.	5	WDFW, USFWS, USFS, USFS, PUDs		300					
Entiat	C, D, E	2	4.3.1	Determine distribution of brook, lake, and brown trout.	5	WDFW, CWU, USGS, Yakama		30					
Entiat	B,C	2	4.3.2	Reduce trans-basin water transfers to the extent possible	10	WDFW, CWU, USGS, Yakama		TBD					
Wenatchee	A	2	1.1.1	Maintain, restore, and protect riparian areas.	O	WDFW, County, NRCS, USFWS, PUDs, BPA	Combined with salmon recovery	3,000					
Wenatchee	A	1	1.1.2	Maintain, restore, and protect riparian zones.	O	USFS, WDNR, WDFW, PTC		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Wenatchee	A	2	1.1.3	Reduce grazing impacts.	O	USFS, WDNR, County, Cons Dist		300					
Wenatchee	A	2	1.1.4	Reduce impacts from suction dredging.	C	WDFW, USFS, Mining groups		500					
Wenatchee	A	2	1.1.5	Reduce impacts to riparian areas, stream banks, stream flow, and water quality.	O	WDFW, DOE, USCOE, County, Cities, Cons Dist	Combined with salmon recovery	10,000					
Wenatchee	A	1	1.1.6	Reduce habitat and floodplain impacts.	O	WSDOT, Fed Hwys, County	Combined w/ salmon recovery	10,000					
Wenatchee	A	2	1.1.7	Reduce impacts from recreation to riparian areas.	C	USFS, WDNR, WDFW, State Parks and Rec, Pvt Rec Groups		5000					
Wenatchee	A	2	1.2.1	Protect and improve riparian areas and floodplains.	O	WDFW, NRCS, Cons Dist, County	Combined with salmon recovery	10,000					
Wenatchee	A	2	1.2.2	Implement stream restoration in degraded stream reaches.	O	USFS, WDNR, PTC, Yakama, BPA, PUDs	Combined with salmon recovery	15,000					
Wenatchee	A	3	1.2.3	Reduce impacts from management to populations already impacted by dewatering.	C	BOR, USFS, WSDOT, Irrig Districts, WDNR		*					
Wenatchee	A	2	1.2.4	Develop adequate passage to connect FMO to spawning and rearing habitat.	O	PUDs, USFS, WDNR, Cons Dist, NRCS		1,000					
Wenatchee	A	1	1.2.5	Connect FMO to spawning and rearing habitat.	5-20	PUDs, WDFW, Yakama, USFWS, NOAA, BPA		5,000					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Wenatchee	D	2	1.2.6	Implement and enforce good mining practices.	C	WDFW, WDNR, USFS, Mining Clubs		5,000					
Wenatchee	A	1	1.2.7	Reduce impacts from development.	C	WDFW, County, Cities, Cons Dists, Ski Areas, USFS	Combined with salmon recovery	*					
Wenatchee	A	1	1.2.8	Reduce impacts to adjacent instream habitat and remove passage barriers.	10	Fed Hwys, WADOT, WDFW, USFS USFWS, NOAA	Combined with salmon recovery	2,000					
Wenatchee	A	1	1.2.9	Secure appropriate instream flows and move towards more natural flow regimes.	C	WDOE, BOR, PUDs, USFWS, NOAA, Yakama	Combined with salmon recovery	*					
Wenatchee	D	1	1.2.10	Meet instream water quality standards.	C	WDOE, EPA, BOR, COE, PUDs, USFS		*					
Wenatchee	E	2	1.2.11	Improve habitat complexity, water quality, and connectivity.	C	WDOE, EPA, PUDs, WDFW, USFS, WDNR, Yakama	Combined with salmon recovery Also See 1.2.5	1,000					
Wenatchee	A	1	2.1.1	Improve connectivity at diversions and improve water quality.	5-10	WDFW, BOR, Irrig. Dist, USFWS, NOAA	Combined with salmon recovery	3,000					
Wenatchee	A	1	2.1.2	Improve and maintain forest roads, decommission where necessary.	O	USFS, WDNR, PTC, Yakama		1,000					
Wenatchee	A	3	2.1.3	Reduce management to improve access and timing of use (*i.e.*, reduce delay to spawning areas).	C	USFS, WDNR, BOR, County, Cities		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Wenatchee	A	1	2.1.4	Reduce entrainment.	5-20	USFWS, PUDs, WDFW, Irrig Dists		1,600					
Wenatchee	A	1	2.1.5	Improve fish passage at all dams, diversions, and road crossings.	5-20	PUDs, WDFW, USFS, WDNR, PTC, Irrig Dists	See Also 1.2.5 & 2.1.2						
Wenatchee	A	1	2.1.6	Reduce impacts from transportation networks.	10	WADOT, Fed Hwys, County	Combined w/ salmon recovery	5,000					
Wenatchee	A		2.1.7	Improve stream flows to a more normative pattern.	5	BOR, WDFW, WDOE, USFWS, NOAA, Yakama, Irrig Dists		3,000					
Wenatchee	A	3	2.1.8	Maintain and improve cool water refuge, water quality and instream flows.	C	PUDs, BPA, BOR, COE, WDNR, WDOE, EPA		1,000					
Wenatchee	B, E	2	2.2.1	Reduce incidental catch and poaching.	C	WDFW, Fishing guides, USFWS		500					
Wenatchee	E	3	2.2.2	Continue to consider stocking of native species a priority.	O	WDFW		*					
Wenatchee	E	3	2.2.3	Reduce impacts from incidental catch from other fisheries monitoring activities.	C	WDFW, PUDs NOAA, Yakama, USFWS		300					
Wenatchee	All	2	2.3.1	Improve genetic and demographic stochasticity.	O	All	Will do this with all actions	*					
Wenatchee	A	1	2.3.2	Improve migratory life history connectivity.	5-20	PUDs, BPA, BOR COE, USFS, WDNR	See 1.2.5						
Wenatchee	E	2	2.3.3	Reduce potential for negative species interactions in populations with low abundances.	O	NOAA, PUDs, USFWS, WDFW		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Wenatchee	All	3	2.4.1	Improve forage fish opportunities.	O	WDFW, BOR, BPA, USFWS, NOAA, Yakama	See 1.2.5 and 2.1.4, and combined with salmon recovery	*					
Wenatchee	B, C	2	2.4.2	Reduce numbers of introduced species.	C	WDFW, USFS, USFWS, NOAA		300					
Wenatchee	D, E	2	2.4.3	Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages.	5-10	WDFW, Yakama, USFWS, NOAA, BPA, PUDs	Combined with salmon recovery	50					
Wenatchee	B, C	1	3.1.1	Reduce numbers of introduced/non-native species.	O	WDFW, Yakama, USFWS, NOAA, BPA, BOR, COE, USFS, WDNR	See 2.4.2	*					
Wenatchee	B	2	3.1.2	Conduct fisheries management to reduce impacts on bull trout.	C	All		*					
Wenatchee	All	2	3.1.3	Plan for and reduce potential for increased non-native competition.	C	WDFW, USFWS		*					
Wenatchee	A	2	4.1.1	Develop information for action plan. Evaluate habitat conditions and determine bull trout potential. Include patch analysis, etc.	5	USGS, WDFW, USFS, USFWS, PUDs	Combined with similar work in other basins	300					
Wenatchee	A, E	2	4.1.2	Continue to monitor key bull trout habitat with temperature probes.	O	USFS, , Yakama, BPA, WDFW, WDNR		200					
Wenatchee	D	2	4.1.3	Evaluate irrigation diversion screens for bull trout.	5	WDFW		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)						
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Wenatchee	A	3	4.1.4	Evaluate low water areas.	O	WDNR, USFS, Pvt Land, Irrig. Dist		100					
Wenatchee	D, E	1	4.1.5	Develop brook trout eradication and monitoring plan.	5	WDFW, USFS, USFWS, NOAA, Yakama		50					
Wenatchee	E	2	4.2.1	Develop an action plan to inform and assess current status of resident and migratory bull trout.	O	WDFW, USFWS		250					
Wenatchee	E	3	4.2.2	Develop long term monitoring program to assess distribution, status, and trend.	5	WDFW, USFWS	other core areas	1,000					
Wenatchee	D, E	2	4.2.3	Determine impacts of incidental catch in other catch fisheries.	O	WDFW, USFWS		50					
Wenatchee	D, E	1	4.2.4	Determine level of poaching.	5	WDFW, USFWS, NOAA		30					
Wenatchee	E	1	4.2.5	Develop food web and predator prey analysis.	5	WDFW, USFWS, USFS, USFS, PUDs		300					
Wenatchee	C, D, E	2	4.3.1	Determine distribution of brook, lake, and brown trout.	5	WDFW, CWU, USGS, Yakama		30					
Yakima	A	2	1.1.1	Maintain, restore, and protect riparian areas.	O	WDFW, Counties, NRCS, USFWS, NGOs	Combined with salmon recovery	12,000					
Yakima	A	1	1.1.2	Maintain, restore, and protect riparian zones.	O	USFS, WDNR, WDFW, PTC, Yakama	Some work part of normal USFS, WDNR activities	TBD					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Yakima	A	2	1.1.3	Reduce grazing impacts.	O	USFS, WDNR, Counties, Cons Dist		1,000					
Yakima	A	2	1.1.4	Reduce impacts to riparian areas and stream banks.	O	WDFW, DOE, USCOE, Counties, Cities, Cons Dist,	Combined with salmon recovery	10,000					
Yakima	A	1	1.1.5	Reduce habitat and floodplain impacts.	O	WSDOT, Fed Hwys, Counties	Combined w/ salmon recovery	10,000					
Yakima	A	2	1.1.6	Reduce impacts from recreation to riparian areas.	C	USFS, WDNR, WDFW, Parks and Rec, Pvt Rec Groups, BT Task Force		5,000					
Yakima	A	2	1.2.1	Protect and improve riparian areas and floodplains.	O	WDFW, NRCS, Cons Dist, Counties	Combined with salmon recovery	10,000					
Yakima	A	2	1.2.2	Implement stream restoration in degraded stream reaches.	O	USFS, WDNR, PTC, Yakama, BOR		15,000					
Yakima	A	3	1.2.3	Reduce cumulative impacts in FMO to populations that are impacted during natural dewatering of spawning and rearing areas.	C	BOR, USFS, WSDOT, Ahtanum Irrig Dist, WDNR		*					
Yakima	A	2	1.2.4	Reduce impacts to riparian areas in spawning reaches.	O	USFS, WDNR, Cons Dist, NRCS,		1,000					
Yakima	A	1	1.2.5	Develop adequate passage to connect FMO to spawning and rearing areas.	5-20	BOR, WDFW, Yakama, USFWS, NOAA, BPA		166,000					
Yakima	A	1	1.2.6	Connect FMO and spawning and rearing habitat.	5-20	BOR, WDFW, Yakama, USFWS, NOAA, BPA	See 1.2.5	TBD					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Yakima	D	3	1.2.7	Implement and enforce good mining practices.	C	WDFW, WDNR, USFS, Mining Clubs		5,000					
Yakima	A	2	1.2.8	Reduce impacts from development.	C	WDFW, Counties, Cities, Cons Dists, Ski Areas, USFS	Combined with salmon recovery	*					
Yakima	A	1	1.2.9	Reduce impacts to adjacent instream habitat and remove passage barriers.	10	Fed Hwys, WADOT, WDFW, USFWS, NOAA	Combined with salmon recovery	*					
Yakima	A	1	1.2.10	Secure appropriate instream flows and move towards more natural flow regimes.	C	WDOE, BOR, USFWS, NOAA, Yakama	Combined with salmon recovery	*					
Yakima	D	2	1.2.11	Meet instream water quality standards.	C	WDOE, EPA, BOR		*					
Yakima	E	2	1.2.12	Improve habitat complexity, water quality, and connectivity.	C	WDOE, EPA, WDFW, USFS, WDNR, Yakama	Combined with salmon recovery Also See 1.2.5	1,000					
Yakima	A	2	2.1.1	Improve connectivity at diversions and improve water quality.	5-10	WDFW, BOR, Irrig. Dist, USFWS, NOAA		3,000					
Yakima	A	1	2.1.2	Improve and maintain forest roads, decommission where necessary.	O	USFS, WDNR, PTC, Yakama		1,000					
Yakima			2.1.3	Continue monitoring and implementation of grazing management plans	O	WDNR, USFS, Pvt Land, Ahtanum Irrig. Dist, BT Task Force	see 4.1.5						

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000) Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Yakima	A	3	2.1.4	Reduce impacts to populations in naturally dewatering reaches to improve access and timing of use (*i.e.*, reduce delay to spawning areas).	C	USFS, WDNR, BOR, Counties, Cities		TBD					
Yakima	A	1	2.1.5	Reduce entrainment.	5-20	BOR, WDFW, Irrig Dist		1,600					
Yakima	A	1	2.1.6	Improve fish passage at Yakima BOR Irrigation project dams, diversions, and road culverts.	5-20	BOR, WDFW, USFS, WDNR, PTC, Irrig Dist,	See Also 1.2.5	TBD					
Yakima	A	1	2.1.7	Reduce impacts from transportation networks.	10	WADOT, Fed Hwys, County,	Combined w/ salmon recovery	5,000					
Yakima	A	1	2.1.8	Improve stream flows to a more normative pattern.	5	BOR, WDFW, WDOE, USFWS, NOAA, Yakama, Irrig Dist		3,000					
Yakima	A	3	2.1.8	Reduce management impacts to populations with limited habitat.	C	All		*					
Yakima	A	3	2.1.10	Maintain and improve cool water refuge, water quality and instream flows.	C	BOR, USFWS, WDNR, WDOE, EPA		1,000					
Yakima	B, E	2	2.2.1	Reduce incidental catch and poaching.	C	WDFW, Guides, BT Task Force		*					
Yakima	E	3	2.2.2	Continue to consider stocking of native species a priority.	O	WDFW		*					
Yakima	E	3	2.2.3	Reduce impacts from incidental catch from other fisheries monitoring activities.	C	WDFW, NOAA, Yakama, USFWS		300					
Yakima	All	2	2.3.1	Improve genetic and demographic stochasticity.	O	All	Will do this with all actions	*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Yakima	A	1	2.3.2	Improve migratory life history connectivity.	5-20	BOR, USFS, WDNR	See 1.2.5	TBD					
Yakima	All	3	2.4.1	Improve forage fish opportunities.	O	WDFW, BOR, USFWS, NOAA, BPA, Yakama	See 1.2.5 and 2.1.4						
Yakima	B, C	2	2.4.2	Reduce numbers of introduced species.	C	WDFW, USFS, USFWS, BT Task Force		300					
Yakima	D, E	3	2.4.3	Identify and reduce impacts from species interactions and coordinate efforts to develop native fish assemblages.	5-10	WDFW, Yakama, USFWS, NOAA, BPA	Combined with salmon recovery	50					
Yakima	B, C	2	3.1.1	Reduce numbers of introduced/non-native species.	O	WDFW, Yakama, USFWS, NOAA, BPA, USFS, WDNR	See 2.4.2	*					
Yakima	B	3	3.1.2	Conduct fisheries management to reduce impacts on bull trout.	C	all		*					
Yakima	B, C, D	2	3.1.3	Plan for and reduce potential for increased non-native competition.	C	WDFW, USFWS		*					
Yakima	A	2	4.1.1	Maintain and Update Yakima Basin Action plan to prioritize actions for recovery.	O	WDFW, USFWS, YBSRB	Include YB BT Tech Team	*					
Yakima	A	2	4.1.2	Conduct patch analysis to evaluate habitat conditions and determine bull trout potential.	5	USGS, WDFW, USFS, USFWS, BOR, YBFWRB		300					
Yakima	A, E	2	4.1.3	Continue to monitor key bull trout habitat with temperature probes.	O	USFS, BT Task Force, Yakama, BPA, WDFW, WDNR	Combined with Task Force $	200					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Yakima	D	2	4.1.4	Evaluate irrigation diversion screens for bull trout.	5	WDFW		*					
Yakima	A	3	4.1.5	Continue to implement grazing management plan monitoring.	O	WDNR, USFS, Pvt Land, Ahtanum Irrig. Dist, BT Task Force		100					
Yakima	D, E	1	4.1.6	Develop brook trout eradication and monitoring plan.	5	WDFW, USFS, USFWS, NOAA, Yakama		50					
Yakima	D	3	4.1.7	Develop Feasibility assessment for Nutrient Supplementation.	5	USFWS, WDFW, NOAA, USFS, WDNR, Yakama		150					
Yakima	D	2	4.1.8	Maintain long term sediment monitoring.	O	USFS, DNR, DOE, Yakama		*					
Yakima	E	2	4.2.1	Continue to maintain Yakima Basin Action Plan to assess current status of resident and migratory bull trout.	O	WDFW, USFWS, YBFWRB	Include YB BT Tech Team	250					
Yakima	E	3	4.2.2	Develop long term monitoring program to assess distribution, status, and trend.	5	WDFW, USFWS		1,000					
Yakima	D, E	3	4.2.3	Determine impacts of incidental catch in other catch fisheries.	O	WDFW, USFWS		50					
Yakima	D, E	3	4.2.4	Determine level of poaching.	5	WDFW, USFWS, BT Task Force		30					
Yakima	E	3	4.2.5	Develop population model necessary for recovering and building local populations.	5	WDFW, USFWS, CWU, USGS		150					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Yakima	D	3	4.2.6	Develop food web analysis and predator/prey relationship in reservoirs, lakes, rivers, and streams.	3	USGS, USFWS, WDFW, BOR, DOE	Food Web analysis currently occurring in Keechelus/ Kachess	250					
Yakima	E	3	4.2.7	Develop feasibility assessment for reintroduction/ translocation of bull trout and implement necessary actions.	13	WDFW, USFWS, Yakama, USFS, USGS, BOR, Task Force	Feasibility. Assessment will take approx. 3 years, reintroduction may take 10 or more years	500	100	100	50	100	100
Yakima	E	3	4.2.8	Evaluate options to facilitate use of bull trout habitat patches identified in the Bull Trout Vulnerability Assessment by Jason Dunham.	3	WDFW, USFWS, USFS, Yakama Nation, BOR		50					
Yakima	C, D, E	2	4.3.1	Determine distribution of brook, lake, and brown trout.	5	WDFW, CWU, BT Task Force, USGS, Yakama		30					
NE WA Research Needs Area	NA	3	4.1.1	Develop list of suitable habitat patches that provide potential spawning and rearing habitat and conduct surveys and evaluations.	2	**USFWS,** USFS, NPS, STI, CTC, WDFW		2	1	1			
NE WA Research Needs Area	NA	3	4.2.1	Develop genetic inventory.	Ongoing	**USFWS,** USFS, NPS, STI, CTC, WDFW		25	5	5	5	5	5
NE WA Research Needs Area	NA	3	4.2.2	Develop a records compilation.	5	**USFWS,** USFS, NPS, STI, CTC, WDFW		5	1	1	1	1	1
NE WA Research Needs Area	NA	3	4.2.3	Collect eDNA samples at focal tributaries.	Ongoing	**USFWS,** USFS, NPS, STI, CTC, WDFW		25	5	5	5	5	5

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
NE WA Research Needs Area	NA	3	4.3.1	Develop a strategy to reduce non-natives and reduce potential invasion by predatory species.	Ongoing	**USFWS,** USFS, NPS, STI, CTC, WDFW		*					
Estimated cost subtotal, Upper Mid-Columbia Geographic Region: $440,877,000 (over 25 years, minimum estimate)													
Lower Snake Geographic Region													
South Fork Clearwater	A	1	1.1.1	Reduce fine sediment production.	Ongoing	**USFS**, **BLM**, County, IDL, ISCC, ITD, NRCS, USFWS		*					
South Fork Clearwater	A	1	1.1.2	Address forest road maintenance and areas with high sediment loading.	Ongoing	**USFS**, **BLM**, IDL, NPT, USFWS		*					
South Fork Clearwater	A	2	1.1.3	Improve maintenance along transportation corridors.	Ongoing	**ITD**, **USDOT**, County, IDL, USFS		*					
South Fork Clearwater	A	2	1.1.4	Restore areas degraded by historical timber harvest.	Ongoing	**USFS**, **BLM**, NPT, IDL, USFWS		*					
South Fork Clearwater	A	2	1.1.5	Revegetate denuded riparian areas.	Ongoing	**BLM**, **IDL**, **NRCS**, **USFS**, IDOT, NPT, USFWS		*					
South Fork Clearwater	A	2	1.1.6	Restore riparian areas where livestock grazing is impacting bull trout habitat.	Ongoing	**BLM**, **IDL**, **USFS**, ISCC, NPT, NRCS, USFWS		*					
South Fork Clearwater	A	2	1.1.7	Implement restoration actions areas in which secondary roads have been constructed in the floodplain.	Ongoing	**ITD**, **County**, **USFS**, **BLM**, IDL, NPT, USFWS		*					
South Fork Clearwater	A	2	1.1.8	Compensate for legacy timber harvest and associated roading practices.	Ongoing	**BLM, IDL, USFS,** NPT, USFWS		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
South Fork Clearwater	A	2	1.1.9	Integrate watershed restoration efforts on public and private lands.	Ongoing	**BLM**, **Counties**, **USFS**, COE, IDL, IDEQ, IDFG, ISCC, NPT, NRCS, USFWS		*					
South Fork Clearwater	A	2	1.2.1	Identify problem mine sites and remediate tailings, ponds, and other associated waste.	Ongoing	**USFS**, BLM, IDEQ, USFWS		*					
South Fork Clearwater	A	1	1.2.2	Restore stream reaches degraded by dredge and placer mining.	Ongoing	**USFS**, **IDEQ**, IDL, BLM, NPT, USFWS		*					
South Fork Clearwater	A	2	1.2.3	Improve instream habitat.	Ongoing	**USFS**, **BLM**, IDFG, NPT, NRCS, IDL, USFWS		*					
South Fork Clearwater	A	2	1.2.4	Improve stream channels near transportation corridors.	Ongoing	**ITD**, **USDOT**, County, IDFG, USFS		*					
South Fork Clearwater	A	2	1.2.5	Implement restoration of overwintering habitat in the mainstem river.	Ongoing	**BLM**, **IDFG**, **NPT**, **USFS**, COE, IDL, IDEQ, USFWS		TBD					
South Fork Clearwater	A	2	1.2.6	Provide long-term protection of perennial stream reaches.	Ongoing	**NRCS**, **BLM**, **IDFG**, **USFS**, USFWS		*					
South Fork Clearwater	A	2	1.2.7	Identify opportunities for habitat restoration and provide assistance to landowners.	Ongoing	**NRCS**, **IDFG**, BLM, Counties, ISCC, USFS, USFWS		*					
South Fork Clearwater	E	1	3.1.1	Reduce brook trout competition with bull trout where they are known to coexist.	10	**IDFG**, **USFS**, BLM, NPT, USFWS	Some funding covered under other programs, agencies	100	10	10	10	10	10

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
South Fork Clearwater	E	3	4.2.1	Determine the abundance of fluvial and resident bull trout and habitat used in the South Fork Clearwater River core area.	25	**IDFG**, **NPT**, **USFS**, BLM, USFWS	Some funding covered under other programs, agencies	100	10	10	10	10	10
Tucannon	A	2	1.1.1	Protect and, where needed, revegetate riparian zones in areas used by bull trout.	Ongoing	WDFW, CTUIR, City, County, Others		*					
Tucannon	A	2	1.1.2	Implement measures identified in the Snake River Salmon Recovery Plan.	Ongoing	SRSRB, WDFW, CTUIR, City, County, Others							
Tucannon	D	2	1.2.1	Incorporate non-intrusive flood repair activities into proactive policy.	Ongoing	CCD, GCCD, FHWA, USFS, WDOT		*					
Tucannon	D	1	1.2.2	Reduce, prevent, and minimize development in floodplains.	Ongoing	CCD, PCD, WDFW, USFS		*					
Tucannon	A	3	1.2.3	Investigate land acquisition from willing sellers as an opportunity to protect bull trout.	Ongoing	USFS, WDFW		*					
Tucannon	E	3	1.2.4	Evaluate the need to install additional permanent stream gauging stations.	2	WDFW, WDOE, USGS		10	10				
Tucannon	A	1	1.2.5	Implement recommendations in the Tucannon River Geomorphic Assessment and Habitat Restoration Study.	25	WDFW, USFWS, NMFS, CCD, PCD, USFS, WDOE		*					
Tucannon	A	2	1.2.6	Identify and restore aggrading stream channels to restore flow, reduce subsurface flows, and increase channel stability.	Ongoing	CCD, PCD, NRCS, WDFW, WDOE, USFS		10	10				

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Tucannon	A	2	1.2.7	Assess and mitigate roads that are floodplain confining.	20	USFS, WDOT, FHWA, CCD, GCCD		*					
Tucannon	A	2	1.2.8	Protect riparian and channel habitat at managed and unmanaged campgrounds, trail systems, and recreation sites.	Ongoing	USFS, WDFW		*					
Tucannon	A	2	1.3.1	Reduce stream temperatures by enhancing riparian area and correcting floodplain connectivity.	Ongoing	CCD, EPA, PCD, WDFW, WDOE, USFS		*					
Tucannon	A	2	1.3.2	Assess water quality and remedy impacts from individual residences and communities.	Ongoing	CCD, WDOE		*					
Tucannon	A	2	1.3.3	Identify unstable and problem roads causing fine sediment delivery.	Ongoing	CCD, GCCD, USFS, WDOT		*					
Tucannon	A	2	1.3.4	Protect riparian and channel habitat at managed and unmanaged campgrounds, trail systems, and recreation sites.	Ongoing	USFS, WDFW		*					
Tucannon	A	2	1.3.5	Reduce sediment inputs from recreational-based channel damage.	Ongoing	USFS, WDFW		*					
Tucannon	A	2	1.3.6	Complete recommendations generated from sediment monitoring and abatement plans.	Ongoing	CCD, CTUIR, NRCS, PCD, USFS, WDFW		*					
Tucannon	A	2	1.3.7	Develop and implement comprehensive livestock grazing management plans.	Ongoing	CCD, NRCS, PCD, USFS		*					
Tucannon	A	1	2.1.1	Remove permanent and seasonal barriers to bull trout migration.	Ongoing	CCD, PCD, WDFW, USFS		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Tucannon	A	1	2.1.2	Modify operation and timing of Tucannon Hatchery Adult trap to reduce impacts to bull trout migration.	Ongoing	USFWS, BPA, WDFW, NMFS, LSRCP		*					
Tucannon	A	1	2.1.3	Assess and remove barriers to movement between local populations.	Ongoing	CCD, PCD, WDFW, USFS		*					
Tucannon	A	1	2.1.4	Review existing bull trout information and determine limiting factors affecting bull trout at Ice Harbor, Lower Monumental, Little Goose, and Lower Granite Dams.	4	ACOE, BPA, WDFW, USFWS		80	20	20	20	20	
Tucannon	A	1	2.1.5	Identify and determine impacts of Snake River Dam operations on habitats for foraging, migrating, and overwintering.	Ongoing	ACOE, BPA, WDFW, USFWS		*					
Tucannon	E	3	3.1.1	Evaluate potential impacts of hatchery rainbow trout.	5	WDFW		*					
Tucannon	C	2	3.1.2	Determine distribution, abundance, and impact of brook trout on bull trout populations.	5	WDFW, USFS, USFWS		25		25			
Tucannon	C	2	3.1.3	Perform feasibility analysis to remove/suppress brook trout in Pataha Creek.	5	WDFW, USFS, USFWS		10			10		
Tucannon	C	3	3.1.4	Encourage brook trout harvest in Pataha Creek.	Ongoing	WDFW		*					
Tucannon	A	1	4.1.1	Monitor the effectiveness of implemented restoration actions in benefitting bull trout and bull trout habitat.	Ongoing	USFWS, WDFW, USFS, ACOE, BPA		*					
Tucannon	A	1	4.2.1	Continue ongoing population monitoring efforts within the basin.	C	USFWS, WDFW, USFS, CTUIR, ACOE		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Tucannon	A	2	4.2.2	Continue maintenance and operation of fish screens on all diversions.	C	WDFW, NMFS, WDOE		*					
Tucannon	A	1	4.2.3	Conduct presence and absence surveys to fully describe the distribution of juvenile, subadult, and adult bull trout.	Ongoing	USFWS, WDFW, ACOE, CTUIR, USFS		*					
Asotin	A	2	1.1.1	Identify unstable and problem roads causing fine sediment delivery.	25	ACCD, USFS, WDOT, County	Existing agency responsibilities; costs associated with non-agency lands	10	10				
Asotin	A	1	1.1.2	Move roads that are in riparian areas out of the floodplain or stabilize them.	25	ACCD, USFS, WDOT	Existing agency responsibilities; costs unknown as each road may require different solutions	*					
Asotin	A	2	1.1.3	Find and eliminate fine sediment sources from historical roads.	25	ACCD, USFS, WDOT	Existing agency responsibilities; costs unknown as each road may require different solutions	*					
Asotin	A	2	1.1.4	Improve routine road maintenance practices.	25	ACCD, USFS, WDOT	Existing agency responsibilities	*					
Asotin	A	2	1.1.5	Investigate land acquisition from willing sellers as an opportunity to protect bull trout.	25	USFS, WDFW	Existing agency responsibilities	*					
Asotin	A	1	1.1.6	Minimize further development in floodplains.	25	ACCD, WDFW, USFS	Existing agency responsibilities	*					
Asotin	A	2	1.1.7	Assess water quality and remedy impacts from individual residences and communities.	25	ACCD, WDOE	Existing agency responsibilities	*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Asotin	A	1	1.1.8	Reduce sediment inputs from recreational-based channel damage.	25	USFS, WDFW, ACCD, WDNR	Existing agency responsibilities	*					
Asotin	A	1	1.1.9	Develop and install educational watershed protection signs in riparian areas of State and Federal campgrounds.	3	USFS, WDFW		15	5	5	5		
Asotin	A	1	1.1.10	Protect riparian and channel habitat at unmanaged/dispersed campsites, trail systems, and recreation sites.	25	USFS, WDFW	Existing agency responsibilities	*					
Asotin	A	2	1.1.11	Conduct a complete inventory of surface water diversions.	3	ACCD, WDFW, WDNR, WDOE		5	5				
Asotin	A	2	1.1.12	Maintain and review comprehensive livestock grazing management plans.	25	ACCD, USFS, WDFW, NRCS	Existing agency responsibilities	*					
Asotin	A	1	1.1.13	Identify and restore riparian vegetation in priority streams.	25	ACCD, USFS, WDFW	Existing agency responsibilities	*					
Asotin	A	2	1.1.14	Reduce fine sediment inputs from agricultural land.	25	ACCD, WDOE, NRCS	Existing agency responsibilities	*					
Asotin	A	1	1.1.15	Reduce impacts of livestock on streams and riparian areas.	25	ACCD, WDFW, WDOE, USFS	Existing agency responsibilities	*					
Asotin	A	2	1.1.16	Review and act on recommendations generated from sediment budget and LiDAR assessments.	25	ACCD, NPT, USFS, WDFW, NRCS	Existing agency responsibilities	*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Asotin	A	2	1.1.17	Stabilize streambeds and banks.	25	ACCD, NRCS, WDFW, USFS	Existing agency responsibilities	*					
Asotin	A	2	1.2.1	Incorporate non-intrusive flood repair activities.	25	ACCD, ACOE, NRCS, WDFW, County, City	Existing agency responsibilities	*					
Asotin	A	2	1.2.2	Promote programs to restore and protect floodplain and channel function.	26	ACCD, ACOE, NRCS, WDFW, County, City	Existing agency responsibilities	*					
Asotin	A	2	1.2.3	Restore stream channels to appropriate channel type.	25	ACCD, USFS, WDFW		220	-	20	25	75	100
Asotin	D	3	1.2.4	Evaluate the need to install and maintain permanent stream gauging stations.	2	WDFW, WDOE, USGS		20	10	10			
Asotin	D	3	1.2.5	Identify sources and locations of groundwater infiltration to streams.	3	ACCD, NRCS, WDFW, WDOE, USFS, USGS		40	20	5	5	5	5
Asotin	A, D	1	1.2.6	Identify factors contributing to elevated stream temperatures.	3	ACCD, WDFW, USFS, WDOE	Existing agency responsibilities	15	5	5	5		
Asotin	A	1	2.1.1	Remove permanent and seasonal barriers to bull trout migration.	25	ACCD, WDFW, USFS	Existing agency responsibilities	*					
Asotin	A	1	2.1.2	Eliminate barriers to bull trout passage at remnant power and irrigation dams.	2	ACCD, WDFW	Existing agency responsibilities	*					
Asotin	A	2	2.1.3	Evaluate passage effectiveness after correction at Headgate Dam.	10	ACCD, WDFW	Existing agency responsibilities	*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Asotin	A	1	2.1.4	Review existing bull trout information and determine limiting factors affecting bull trout at Snake River Dams.	2	ACOE, BPA, WDFW, USFWS		40	20	20			
Asotin	A	1	2.1.5	Identify study needs related to habitats for foraging, migrating, and overwintering in Snake River reservoirs.	3	ACOE, BPA, WDFW, USFWS		50		10	20	20	
Asotin	A	2	2.3.1	Conduct watershed analyses to evaluate past, current, and future bull trout production potential.	10	WDFW, USFS, USFWS	Existing agency responsibilities	*					
Asotin	A	2	2.3.2	Investigate use of prescribed fire.	5	USFS	Existing agency responsibilities	*					
Asotin	A	3	2.3.3	Build on current and recent PIT tagging	10	USFWS, WDFW, Utah State		*					
Asotin	A	2	4.1.1	Evaluate condition and status of forage base throughout watershed.	5	ACOE, BPA, WDFW, USFWS		100	20	20	20	20	20
Asotin	A	2	4.2.1	Conduct genetic inventory.	5	USFS, USFWS, WDFW		45	15	15	15		
Asotin	A	1	4.2.2	Conduct presence and absence surveys to fully describe the distribution of juvenile, subadult, and adult bull trout.	5	USFS, USFWS, WDFW		50	10	10	10	10	10
Asotin	A	1	4.2.3	Determine whether the hydropower system on the lower Snake River is adversely affecting migratory bull trout from the Asotin Creek Core Area.	5	ACOE, BPA, WDFW, USFWS		100	20	20	20	20	20
Asotin	C	3	4.3.1	Evaluate potential impacts of hatchery rainbow trout.	5	USFS, USFWS, WDFW	Existing agency responsibilities	*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Asotin	C	3	4.3.2	Evaluate impacts of non-native predatory species in mainstem Snake River.	5	ACOE, BPA, WDFW, USFWS		115	30	25	20	20	20
Upper Grande Ronde	A	2	1.1.1	Restore riparian zones associated with bull trout habitat.	25	BCC, CTUIR, ODA **GRMWP**, NRCS, ODF, NPT, ODFW, **USFS**, , BLM, Landowner	Ongoing efforts	375	15	15	15	15	15
Upper Grande Ronde	A	2	1.1.2	Identify and reduce sources of excessive fine sediment delivery.	3	BCC, SWCD, BOR, **ODFW**, USFS, DOA, ODF, ODEQ, NRCS, BPA, ODOT, GRMWP, SWCD, BLM, Landowner	Identify and correct human caused sources of sediment in known or suspected spawning and rearing areas.	45	15	15	15		
Upper Grande Ronde	A	2	1.1.3	Reduce grazing impacts.	10	**BLM, BOR**, ODFW, **USFS**, ODA, ODF, GRMWP, NRCS, SWCD, Landowner	Ongoing efforts	200	10	15	20	15	10
Upper Grande Ronde	A	2	1.2.1	Implement stream restoration projects in degraded stream reaches.	3	**ODFW**, NRCS, SWCD, USFS		30	10	10	10		
Upper Grande Ronde	A	2	1.2.2	Improve and secure appropriate instream flows.	10	**ODFW**, NRCS, WT, OWRD		125	5	5	5	5	5
Upper Grande Ronde	A	2	2.1.1	Implement stream, riparian, and flow restoration measures described in section one to remedy temperature and low flow barriers.	25	Identified above	Costs accounted for in previous measures	*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Upper Grande Ronde	A	2	4.1.1	Evaluate habitat condition and determine bull trout use of the Grande Ronde Valley.	3	**GRMWP**, ODFW		140	60	20	20	20	20
Upper Grande Ronde	E	2	4.2.1	Assess current status of resident and migratory bull trout in the Upper Grande Ronde Core Area.	3	ODFW, USFWS, CUTIR, USFS		60	20	20	20		
Upper Grande Ronde	E	2	4.2.2	Develop a long term monitoring program to assess distribution, status and trend of bull trout in the Upper Grande Ronde Core Area.	Ongoing	BLM, ODFW, USFS, **USFWS**		100	20	20	20	20	20
Upper Grande Ronde	E	2	4.2.3	Identify local populations in the Upper Grande Ronde Core Area.	3	BPA, ODFW, USFS, **USFWS**		500	100	200	200		
Upper Grande Ronde	E	2	4.2.4	Determine the distribution of bull trout, particularly in systems of unknown distribution.	3	BCC, **ODFW**, USFS		45	15	15	15		
Upper Grande Ronde	E	2	4.3.1	Determine distribution of brook trout in populations in Upper Grande Ronde.	5	BPA, **ODFW, USFWS**		125	25	25	25	25	25
Wallowa/ Minam	A	1	1.3.1	Restore riparian zones associated with bull trout habitat.	25	BCC, WDFW, CTUIR, ODA **GRMWP**, NRCS, ODF, NPT, ODFW, **USFS**, BLM, Landowner	Ongoing efforts	375	15	15	15	15	15
Wallowa/ Minam	A	1	1.3.3	Improve and secure appropriate instream flows.	10	**ODFW**, NRCS, WT, OWRD		125	5	5	5	5	5
Wallowa/ Minam	A	2	1.3.4	Implement irrigation water efficiency projects to increase instream flows.	10	**SWCD, Irrigators**		TBD					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Wallowa/ Minam	A	3	1.3.5	Monitor the effects of diversions and withdrawals on stream temperature and bull trout migration, and modify as necessary.	3	**ODFW**, USFS, NRCS, SWCD	Modify the management of diversions and withdrawals as necessary for bull trout.	450	150	150	150		
Wallowa/ Minam	A	3	1.3.2	Implement stream restoration projects in degraded stream reaches.	3	**ODFW**, NRCS, SWCD	Implement if necessary	30	10	10	10		
Wallowa/ Minam	E	2	3.1.1	Assess the distribution of brook trout and bull trout and determine rates of hybridization in reaches where they co-occur.	5	**ODFW, USFWS, USFS**		125	25	25	25	25	25
Wallowa/ Minam	E	2	3.1.2	Implement management actions to reduce, control or eradicate brook trout where necessary and feasible.	28	**ODFW, USFWS, USFS**		*					
Wallowa/ Minam	B	2	4.2.1	Evaluate incidental catch and illegal harvest from recreational angling.	5	**ODFW, USFS**		50	10	10	10	10	10
Wallowa/ Minam	E	2	4.2.2	Assess current status of resident and migratory bull trout in the Upper Grande Ronde Core Area.	3	ODFW, USFWS, CUTIR, USFS		60	20	20	20		
Wallowa/ Minam	E	2	4.2.3	Develop a long term monitoring program to assess distribution, status and trend of bull trout in the Wallowa/Minam Core Area.	Ongoing	BLM, ODFW, USFS, **USFWS**		100	20	20	20	20	20
Wallowa /Minam	E	2	4.2.4	Identify local populations in the Wallowa/Minam Core Area.	3	ODFW, USFS, **USFWS**		500	100	200	200		
Wallowa/ Minam	A	2	4.2.5	Continue monitoring, maintenance and operation of fish screens on all diversions.	Ongoing	Irrigators, ODFW		TBD					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000) Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Little Minam	E	2	4.2.1	Develop a long term monitoring program to assess distribution, status and trend of bull trout in the Wallowa/Minam Core Area.	25	ODFW, USFS, **USFWS**		10	5			5	
Little Minam	E	2	4.2.2	Identify local populations in the Little Minam Core Area.	3	**ODFW**, USFS, **USFWS**		15	5	5	5		
Lookingglass/ Wenaha	B	3	4.2.1	Evaluate incidental catch and illegal harvest by recreational anglers.	5	**ODFW, OSP USFS**		50	10	10	10	10	10
Lookingglass/ Wenaha	E	3	4.2.2	Develop a long term monitoring program to assess distribution, status and trend of bull trout in the Lookingglass/Wenaha Core Area.	Ongoing	BLM, ODFW, USFS, **USFWS**, WDFW		100	20	20	20	20	20
Lookingglass/ Wenaha	E	3	4.2.3	Identify local populations in the Lookingglass/Wenaha Core Area.	3	**ODFW, WDFW, USFS, USFWS**		75	25	25	25		
Lookingglass/ Wenaha	E	3	4.2.4	Determine the distribution of bull trout, particularly in systems of unknown distribution.	3	**ODFW**, USFS		45	15	15	15		
Lookingglass/ Wenaha	E	3	4.2.5	Investigate use of the mainstem Snake River by bull trout from the Lookingglass/Wenaha Core Area.	5	**ODFW**, BPA ACOE, **USFWS**, **WDFW**		750	150	150	150	150	150
Lookingglass/ Wenaha	A	3	4.2.6	Assess whether operation of the Lookingglass Hatchery weir is having an adverse impact on bull trout.	3	**ODFW, CTUIR,** USFWS		TBD					
Lookingglass/ Wenaha	E	2	4.3.1	Assess the distribution and interaction between bull trout and brook trout in Lookingglass Creek.	5	BPA, ODFW, USFWS		125	25	25	25	25	25

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000) Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Imnaha River	A	3	4.1.1	Evaluate the impacts of Lower Granite Dam and Hells Canyon Dam.	5	BPA, IPC, ODFW, ACOE, USFS, **USFWS**		1,000	200	200	200	200	200
Imnaha River	A	2	4.2.1	Continue to evaluate the impacts of the hatchery intakes at ODFW's Imnaha Satellite Facility.	2	**NPT**, **ODFW**, USFWS	Insure that intakes are screened properly.	30	15	15			
Imnaha River	B	3	4.2.2	Evaluate incidental and illegal catch from recreational angling.	3	**ODFW, USFWS,** OSP		30	10	10	10		
Imnaha River	A	3	4.2.3	Continue to monitor bull trout in the Imnaha Core Area.	25	BPA, NPT, **ODFW**, USFS, USFWS	Provides information on distribution and abundance for recovery.	625	25	25	25	25	25
Imnaha River	E	3	4.2.4	Conduct a genetic analysis of bull trout in the Imnaha River basin.	3	BPA, **ODFW**, USFS, **USFWS**		100	25	25	25		
Imnaha River	A	3	4.2.5	Evaluate the influence of the Imnaha Weir on bull trout migration consistent with term and conditions in the 2015 biological opinion from the USFWS on operation and maintenance of the weir.	4	ODFW, USFWS, NPT, CTUIR	Preliminary assessment of migration delay at weir was initiated in 2015	125	25	25	25	25	25
Estimated cost subtotal, Lower Snake Geographic Region: $7,800,000 (over 25 years, minimum estimate)													
Middle-Snake Geographic Region													
Powder River	A	1	1.1.1	Restore shade and canopy cover provided by riparian vegetation along stream reaches where riparian habitats have been degraded.	25	**BLM**, councils, **landowners**, **NRCS,** ODFW, USFWS, **USFS**	Ongoing.	500	20	20	20	20	20

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Powder River	A	2	1.1.2	Evaluate potential effects of degraded upland areas on stream and riparian habitats and implement actions, where appropriate, to restore diverse native vegetation communities and processes.	5	**BLM, councils**, **NRCS,** ODEQ, ODFW, **USFS**	Cost estimate for evaluation.	250	50	50	50	50	50
Powder River	A	2	1.1.3	Assess and address threats of sediment production from roads and other sources (*e.g.*, mines, improperly grazed areas, inappropriate use of recreational vehicles) known to be contributing sediment to streams.	25	**counties**, ODEQ, ODF, **ODOT**, **USFS**		TBD					
Powder River	A	2	1.1.4	Reduce Grazing Impacts.	25	**BLM**, councils, **landowners**, **NRCS,** ODFW, USFWS, **USFS**	Ongoing.	500	20	20	20	20	20
Powder River	A	1	1.2.1	Restore floodplain function and channel complexity in areas utilized, or potentially utilized, by bull trout.	25	**BLM**, councils, **landowners**, **NRCS, ODFW**, USFWS, **USFS**	Cost estimate for identification of sites.	500	20	20	20	20	20
Powder River	A	2	1.2.2	Assess mine sites for potential negative effects on bull trout and bull trout habitats and rehabilitate sites determined to be problems.	5	**ODEQ,** USFS	Cost estimate for evaluation of sites.	250	50	50	50	50	50
Powder River	A	2	1.2.3	Curtail unauthorized instream mining activity.	Ongoing	**USFS, ODFW, BLM**		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Powder River	A	1	1.3.1	Improve and secure instream flows.	Ongoing	Districts, Operators, Landowners, Councils BOR, USFWS, ODFW		1,000					
Powder River	A	1	2.1.1	Inventory and identify water diversion structures and ditches affecting bull trout and implement actions to remedy entrainment and passage issues.	10	councils, districts, **NRCS, ODFW**, operators, USFS		2,000	200	200	200	200	200
Powder River	A	2	2.1.2	Inventory and assess road crossings to identify fish passage barriers and implement actions to provide passage where appropriate.	5	**BLM, counties, ODOT, USFS**	Ongoing.	*					
Powder River	A	2	2.1.3	Evaluate alternatives for improving stream function and fish passage in lower Deer Creek including and evaluation of removing the old highway road bed on Deer Creek into Philips Reservoir.	5	**BOR,** USFWS		TBD					
Powder River	A	1	2.1.4	Identify dewatered areas where insufficient stream flow creates passage barriers, and develop and implement actions to provide fish passage.	25	councils, districts, NRCS, **ODFW,** operators, BOR, USFS	Cost estimate for identification of sites and development of actions.	750	30	30	30	30	30
Powder River	E	2	3.1.1	Evaluate presence/absence of brook trout in bull trout habitat.	5	**ODFW,** USFWS, USFS	Cost and time estimate for evaluation.	300	60	60	60	60	50
Powder River	E	2	3.1.2	Assess severity of threat due to hybridization with brook trout where the two species co-occur in the Powder River Basin.		ODFW, USFWS, USFS		100	20	20	20	20	20

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Powder River	E	1	3.1.3	Implement brook trout removal, control or eradication efforts wherever feasible and biologically supportable.	25	**ODFW** USFWS, USFS		TBD					
Powder River	A	2	4.1.1	Continue to evaluate bull trout use of reservoirs in the Powder River Core Area.	Ongoing	ODFW, **BOR**		TBD					
Powder River	A	2	4.1.2	Continue to monitor water quality downstream of mine sites.	Ongoing	Councils, ODEQ, USFS		50	10	10	10	10	10
Powder River	E	2	4.2.1	Develop a long term monitoring program to assess distribution, status and trend of bull trout in the Powder River Core Area.	Ongoing	ODFW, USFWS, USFS		*					
Powder River	E	1	4.2.2	Conduct regular surveys in areas where bull trout status is unknown and those identified as having potential spawning and rearing habitat.		OSFW, USFWS, USFS		500	20	20	20	20	20
Powder River	E	2	4.2.3	Collect samples for genetic analysis to contribute to establishing a program to understand the genetic baseline and monitor genetic changes throughout the range of bull trout.	25	BLM, ODFW, **USFWS**, USFS		TBD					
Powder River	E	2	4.3.1	Continue monitoring Tiger Muskie in Phillips Reservoir.	3	**ODFW**, BOR, USFS		*					
Pine/Indian/ Wildhorse	A	1	1.2.1	Improve and secure instream flows.	Ongoing	Districts, Operators, Landowners, Councils, IPC, USFWS, ODFW		1,000					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Pine/Indian/ Wildhorse	A	1	2.1.1	Inventory and identify water diversion structures and ditches affecting bull trout and implement actions to remedy entrainment and passage issues.	10	councils, districts, **NRCS, ODFW**, operators, USFS, IPC		2,000	200	200	200	200	200
Pine/Indian/ Wildhorse	A	3	2.1.2	Investigate and implement methods to provide two-way fish passage at Hells Canyon and Oxbow Dams.	5	**IPC,** FERC, USFWS	Implement once 2.1.1 has been addressed	TBD					
Pine/Indian/ Wildhorse	A	1	2.1.3	Identify dewatered areas where insufficient stream flow creates passage barriers, and develop and implement actions to provide fish passage.	25	councils, districts, IPC, NRCS, **ODFW,** operators, BOR, USFS	Cost estimate for identification of sites and development of actions.	750	30	30	30	30	30
Pine/Indian/ Wildhorse	E	2	3.1.1	Evaluate presence/absence of brook trout in bull trout habitat.	5	**ODFW,** USFWS, USFS, IPC	Cost and time estimate for evaluation.	300	60	60	60	60	50
Pine/Indian/ Wildhorse	E	2	3.1.2	Assess severity of threat due to hybridization with brook trout where the two species co-occur in the Pine/Indian/Wildhorse Creeks Core Area.	5	**ODFW**, USFWS, USFS, IPC		100	20	20	20	20	20
Pine/Indian/ Wildhorse	E	1	3.1.3	Implement brook trout removal, control or eradication efforts wherever feasible and biologically supportable.	25	**ODFW**, IPC, USFWS, USFS		TBD					
Pine/Indian/ Wildhorse	E	2	4.2.1	Develop a long term monitoring program to assess distribution, status and trend of bull trout in the Pine/Indian/Wildhorse Creeks Core Area.	Ongoing	ODFW, **USFWS**, USFS, IPC		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Pine/Indian/ Wildhorse	E	2	4.2.2	Conduct regular surveys in areas where bull trout status is unknown and those identified as having potential spawning and rearing habitat.	Ongoing	ODFW, USFWS, USFS, IPC		500	20	20	20	20	20
Pine/Indian/ Wildhorse	E	2	4.2.3	Conduct an investigation of bull trout genetics in the Pine/Indian/Wildhorse Creeks Core Area.	25	**ODFW**, **USFWS**, USFS		TBD					
Estimated cost subtotal, Middle Snake Geographic Region: $11,350,000 (over 25 years, minimum estimate)													
Estimated total cost of recovery actions within the Mid-Columbia Recovery Unit: $562,491,000. (over 25 years, minimum estimate)													
Time to Recovery (estimated time required to meet recovery criteria within this recovery unit): 25 years (3-5 bull trout generations)													

Conservation Recommendations for the Mid-Columbia Recovery Unit

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Upper Mid-Columbia Geographic Region													
North Fork John Day	A	Cons Rec		Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist.	Ongoing	**USFWS, ODFW, USFS, CTUIR, BLM**							
North Fork John Day	A	Cons Rec		Provide long-term habitat protection through purchase from willing sellers, conservation easements, management plans, etc.	25	**CTUIR CTWSR, NPPC, USFWS**, NOAA, ODFW, BPA							
Middle Fork John Day		Cons Rec		Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist.		**ODFW, USFWS, USFS, CTUIR, CTWSR**							
Middle Fork John Day	A	Cons Rec		Assess and address threat of sediment sources in Upper John Day Basin affecting bull trout.	25	**ODF, ODOT, PTC, USDOT**, USFS, BLM SWCD, WC							
Middle Fork John Day	A	Cons Rec		Install appropriate fish screens at diversions to prevent the entrainment of fish into irrigation systems.	7	**NOAA, ODFW, BOR, USFWS,** I							

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Middle Fork John Day	A	Cons Rec		Provide long-term habitat protection through purchase from willing sellers, and development of conservation easements.		**USFS, ODFW, CTUIR, CTWSR,**							
Upper Mainstem John Day	All	Cons Rec		Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist.	Ongoing	**USFWS, USFS, ODFW, CTWSR**							
Upper Mainstem John Day	E	Cons Rec		Monitor the distribution of brook trout in the Core Area.	5	**ODFW, USFWS**, USFS							
Upper Mainstem John Day	A	Cons Rec		Assess and address threat of sediment sources in Upper John Day Basin affecting bull trout.	25	**ODF, ODOT, PTC, USDOT**, USFS, BLM SWCD, WC	See Watershed Assessments and Travel Management Plans						
Umatilla	All	Cons Rec		Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist.	Ongoing	OSFW, USFWS, CTUIR, WC, ACOE, USFS							

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000) Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Umatilla	D	Cons Rec		Give high priority to enforcement of bull trout angling regulations.	25	ODFW, OSP, CTUIR USFS LE, USFWS LE	Ongoing						
Umatilla	D	Cons Rec		Provide information to the public about bull trout identification, special regulations, and habitat needs (including bi-lingual signing).	5	ODFW, CTUIR, USFS, BLM, WC, Educ Institutions							
Umatilla	A	Cons Rec		Evaluate and implement actions to encourage beaver recolonization.	Ongoing	ODFW, CTUIR, USFWS							
Walla Walla	All	Cons Rec		Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist.	Ongoing	ODFW, WDFW, USFS, USFWS, CTUIR, WWBWC							
Walla Walla	E	Cons Rec		Maintain bull trout protection as high priority for Oregon's Cooperative Enforcement Program and Washington Department of Fish and Wildlife enforcement division.	25	ODFW, OSP, WDFW LE, USFS LE, USFWS LE, CTUIR	Ongoing						

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Walla Walla	E	Cons Rec		Provide information to the public about bull trout identification, special regulations, and habitat needs (including bi-lingual signing).	5	ODFW, WDFW, CTUIR, USFS, BLM, WC, Educational Institutions							
Walla Walla	E	Cons Rec		Evaluate alternative access across river for cabin owners in the South Fork Walla Walla R. between National Forest boundary and Harris Park.	3	BLM							
Upper Mid-Columbia Geographic Region													
Okanogan FMO	All	Cons Rec		Continue to support existing Upper Columbia Bull Trout Technical Work Group.	O	All Partners, USFWS, UCSRB							
Okanogan FMO	A	Cons Rec		Develop whole watershed restoration planning.	O	USFS USFWS, WDFW, BOR, BPA, COE, Yakama							
Chelan Historic Core Area and FMO Habitat	All	Cons Rec		Continue to support existing Upper Columbia Bull Trout Technical Work Group.	O	All Partners, USFWS, UCSRB							
Chelan Historic Core Area and FMO Habitat	A	Cons Rec		Develop whole watershed restoration planning.	O	USFS USFWS, WDFW, BOR, BPA, COE, Yakama							

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Chelan Historic Core Area and FMO Habitat	All	Cons Rec		Insure coordination with Columbia River Federal Power System and PUD FERC Relicensing Projects.	O	PUDs, BPA, COE, , WDFW, Yakama, USFWS, NOAA							
Methow	All	Cons Rec		Continue to support existing Upper Columbia Bull Trout Technical Work Group.	O	All Partners, USFWS, UCSRB							
Methow	A	Cons Rec		Develop whole watershed restoration planning.	O	USFS USFWS, WDFW, BOR,,BPA, COE, Yakama							
Entiat	All	Cons Rec		Continue to support existing Upper Columbia Bull Trout Technical Work Group.	O	All Partners, USFWS, UCSRB							
Entiat	A	Cons Rec		Develop whole watershed restoration planning.	O	USFS USFWS, WDFW, BOR, BPA, COE, Yakama							
Entiat	All	Cons Rec		Insure coordination with Columbia River Federal Power System and PUD FERC Relicensing Projects.	O	PUDs, BPA, COE, , WDFW, Yakama, USFWS, NOAA							
Wenatchee	All	Cons Rec		Continue to support existing Upper Columbia Bull Trout Technical Work Group.	O	All Partners, USFWS, UCSRB							

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000) Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Wenatchee	A	Cons Rec		Develop whole watershed restoration planning.	O	USFS USFWS, WDFW, BOR, BPA, COE, Yakama,							
Wenatchee	All	Cons Rec		Insure coordination with Columbia River Federal Power System and PUD FERC Relicensing Projects.	O	PUDs, BPA, COE, , WDFW, Yakama, USFWS, NOAA,							
Yakima	All	Cons Rec		Continue to support existing Yakima Basin Bull Trout Technical Work Group.	O	All Partners, USFWS							
Yakima	A	Cons Rec		Develop whole watershed restoration planning.	O	USFS USFWS, WDFW, BOR, Yakama, NGOs							
Yakima	All	Cons Rec		Insure coordination with Columbia River Federal Power System Projects.	O	YBFWRB, WDFW, Yakama, USFWS, NOAA, BPA							
Lower Snake Geographic Region													
All Four Clearwater Cores	All	Cons Rec		Conduct presence/absence surveys in previously uninventoried areas.		**IDFG**, **NPT**, **USFS**, BLM, USFWS							
North Fork Clearwater, Lochsa, Selway	All	Cons Rec		Determine the abundance of fluvial, adfluvial, and resident bull trout and habitat used.		**IDFG**, **NPT**, **USFS**, BLM, USFWS							

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
All Four Clearwater Cores	E	Cons Rec		Monitor brook trout expansion.		**IDFG**, **USFS**, BLM, NPT, USFWS							
All Four Clearwater Cores	E	Cons Rec		Evaluate extent of hybridization between bull and brook trout in areas where brook trout are firmly established and eradication is not possible.		**IDFG**, **USFS**, BLM, NPT , USFWS							
All Four Clearwater Cores	A	Cons Rec		Ensure restrictions on suction dredge mining in bull trout habitat are effective.		**BLM**, **IDWR**, **USFS**, IDFG, USFWS							
All Four Clearwater Cores	A	Cons Rec		Ensure current mining regulations are effective.		**BLM**, **IDEQ**, **IDWR**, **USFS**, IDFG, USFWS							
North Fork Clearwater	A	Cons Rec		Evaluate direct losses of bull trout through Dworshak Dam.		**COE**, **IDFG**, **IDWR**, USFWS							
All Four Clearwater Cores	B	Cons Rec		Evaluate the amount and relative threat of illegal bull trout harvest and incidental fishing mortality.		**IDFG**, NPT, USFWS							
All Four Clearwater Cores	E	Cons Rec		Evaluate the potential for release of excess hatchery stock of anadromous fish into occupied bull trout habitat.		**IDFG**, **NPT**, **USFWS**							
North Fork Clearwater	E	Cons Rec		Evaluate the need for reestablishing genetic connectivity between the North Fork Clearwater River and the remainder of the recovery unit.		**IDFG**, **USFWS**, NPT, USFS							
All Four Clearwater Cores	E	Cons Rec		Conduct a genetic inventory.		**IDFG**, **NPT**, USFS, USFWS							

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
North Fork Clearwater, Lochsa, Selway, mainstem shared FMO habitat	A	Cons Rec		Reduce fine sediment production.		**IDL, USFS**, BLM, County, COE, IDEQ, ISCC, ITD, IDWAG, NRCS, USFWS							
North Fork Clearwater, Lochsa	A	Cons Rec		Address forest road maintenance and areas with high sediment loading.		**IDL, USFS**, BLM, NPT, USFWS							
North Fork Clearwater, Lochsa, mainstem shared FMO habitat	A	Cons Rec		Improve maintenance along transportation corridors.		**ITD, USDOT,** County, IDL, USFS							
North Fork Clearwater, Lochsa	A	Cons Rec		Restore areas degraded by historical timber harvest.		**IDL, USFS**, BLM, NPT, USFWS							
North Fork Clearwater, Lochsa	A	Cons Rec		Revegetate degraded riparian areas.		**BLM, IDL, NRCS, USFS**, IDOT, NPT, USFWS							
North Fork Clearwater, Lochsa	A	Cons Rec		Implement restoration actions in areas in which secondary roads have been constructed in the floodplain.		**ITD, County, IDFG, USFS**, BLM, IDL, NPT, USFWS							
North Fork Clearwater, Lochsa	A	Cons Rec		Compensate for legacy timber harvest and associated roading practices.		**BLM, IDL, USFS,** NPT, USFWS							
North Fork Clearwater, Lochsa, mainstem shared FMO habitat	A	Cons Rec		Integrate watershed restoration efforts on public and private lands.		**BLM, Counties, USFS,** COE, IDL, IDEQ, IDFG, ISCC, NPT, NRCS, USFWS							

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
North Fork Clearwater	A	Cons Rec		Identify problem mine sites and remediate tailings, ponds, and other associated waste.		**IDL, USFS**, IDEQ, USFWS							
North Fork Clearwater	A	Cons Rec		Restore stream reaches degraded by dredge and placer mining.		**USFS, IDEQ,** USFWS							
North Fork Clearwater, Lochsa, mainstem shared FMO habitat	A	Cons Rec		Improve instream habitat.		**IDL, USFS**, BLM, IDFG, NPT, NRCS, USFWS							
Lochsa	A	Cons Rec		Implement actions to restore areas of Fish Lake Creek (Lochsa River) degraded by channelization and excessive bank erosion associated with the Fish Lake airstrip and campsites.		**USFS, IDFG,** USFWS							
North Fork Clearwater, Lochsa, mainstem shared FMO habitat	A	Cons Rec		Improve stream channels near transportation corridors.		**ITD, USDOT,** County, IDFG, USFS							
North Fork Clearwater, Lochsa, mainstem shared FMO habitat	A	Cons Rec		Implement restoration of overwintering habitat in the mainstem rivers.		**BLM, IDFG, NPT, USFS**, COE, IDL, IDEQ, NRCS USFWS							
North Fork Clearwater, Lochsa	A	Cons Rec		Provide long-term protection of perennial stream reaches.		**BLM, IDFG, USFS, USFWS**							

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
North Fork Clearwater, Lochsa, mainstem shared FMO habitat	A	Cons Rec		Identify opportunities for habitat restoration and provide assistance to landowners.		**NRCS, IDFG**, BLM, Counties, ISCC, UFS, USFWS							
All Four Clearwater Cores and mainstem shared FMO habitat	A	Cons Rec		Mitigate point and nonpoint thermal pollution.		**EPA**, IDEQ, ISCC, NRCS							
All Four Clearwater Cores and mainstem shared FMO habitat	A	Cons Rec		Eliminate or reduce the number and length of stream segments with impaired water quality.		**IDEQ,** Counties, EPA, USFS, USFWS							
South Fork Clearwater, North Fork Clearwater, Lochsa	A	Cons Rec		Eliminate known culvert and other man-made passage barriers.		**IDL, ITD, USFS,** County, IDFG, USFWS							
All Four Clearwater Cores and mainstem shared FMO habitat	B	Cons Rec		Continue public outreach about fishing regulations, bull trout identification, and proper handling/release techniques.		**IDFG, USFWS, USFS**, BLM, NPT							
All Four Clearwater Cores and mainstem shared FMO habitat	B	Cons Rec		Decrease incidental mortality of bull trout due to angling.		**IDFG,** NPT, USFWS							
All Four Clearwater Cores and mainstem shared FMO habitat	B	Cons Rec		Continue enforcement activities relating to regulations prohibiting bull trout harvest.		**IDFG, USFS,** BLM, NPT, USFWS							

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
North Fork Clearwater	A	Cons Rec		Operate Dworshak Dam to reduce losses of kokanee salmon.		**COE, IDFG**, IDWR, USFWS							
North Fork Clearwater, Lochsa, Selway, mainstem shared FMO habitat	E	Cons Rec		Reduce brook trout competition with bull trout where they are known to coexist.		**IDFG, USFS,** BLM, NPT, USFWS							
Upper Grande Ronde	All	Cons Rec		Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist.	Ongoing	USFWS, ODFW, USFS, CTUIR							
Upper Grande Ronde	A	Cons Rec		Addresses passage and screening issues.	Ongoing	ODFW, USFWS, USFS, NRCS, SWCD, ODOT, ODF, CUTIR, BLM, Landowners							
Wallowa/ Minam	All	Cons Rec		Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist.	Ongoing	USFWS, ODFW, USFS, CTUIR, NPT							

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Wallowa/ Minam	A	Cons Rec		Identify and reduce sources of excessive fine sediment delivery.	3	BCC, SWCD, BOR, **ODFW**, USFS, DOA, ODF, ODEQ, NRCS, BPA, ODOT, GRMWP, SWCD, BLM, Landowner	Identify and correct human caused sources of sediment in known or suspected spawning and rearing areas.						
Wallowa/ Minam	A	Cons Rec		Address screening and passage issues.	2	**ODFW**, USFS, NRCS, SWCD USFWS, **CTUIR, NPT**							
Wallowa/ Minam	A	Cons Rec		Reduce grazing impacts.	10	**BLM, BOR**, ODFW, **USFS**, ODA, ODF, GRMWP, NRCS, SWCD, Landowner	Ongoing efforts						
Little Minam	All	Cons Rec		Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist.	Ongoing	**USFWS, ODFW, USFS**							
Little Minam	A	Cons Rec		Assess current risk of catastrophic fire to the Little Minam bull trout population.		**USFS**							

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Lookingglass /Wenaha	A	Cons Rec		Promote and support water quality improvement actions in the Upper Grande Ronde Core Area. Poor water quality conditions related to temperature, nutrients and low flows in the Lower Grande Ronde River are a direct result of land use and management in the Upper Grande Ronde Valley.	Ongoing	BCC, SWCD, BOR, **ODFW**, USFS, DOA, ODF, ODEQ, NRCS, BPA, ODOT, GRMWP, SWCD, BLM, Landowner							
Lookingglass /Wenaha	A	Cons Rec		If an assessment of the Lookingglass Fish Hatchery weir suggests adverse impacts to bull trout are occurring (RM&E action 4.2.6), then design and implement modifications to the weir and/or its timing of operation to minimize or eliminate adverse impacts.	TBD	ODFW							
Lookingglass /Wenaha	A	Cons Rec		Ensure that hatchery intakes are screened properly and are not impacting bull trout. Assess the impacts to bull trout of operating hatchery intakes at Lookingglass Fish Hatchery. Ensure the screens on the intakes are properly operated and maintained.	TBD	ODFW, CTUIR, USFWS							

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000) Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Lookingglass /Wenaha	All	Cons Rec		Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist.	Ongoing	USFWS, ODFW, WDFW, USFS, CTUIR							
Imnaha River	A	Cons Rec		Remedy impaired connectivity issues associated with the Wallowa Valley Improvement Canal.	5	NRCS, **ODFW**, USFS, USFWS, WVID							
Imnaha River	A	Cons Rec		Protect and restore riparian zones within bull trout habitat.	25	BLM, NPT, NRCS, ODFW, **USFS**							
Imnaha River	A	Cons Rec		Reduce grazing impacts.	10	BLM, BOR, IDFG, ODFW, **USFS**							
Imnaha River	A	Cons Rec		Identify sources of sediment delivery.	3	BLM, BOR, **IDFG**, NRCS **ODFW**, USFS	Take corrective action if necessary and appropriate.						
Imnaha River	A	Cons Rec		Salvage stranded bull trout..	25	**ODFW**, USFS							
Imnaha River	A	Cons Rec		Identify and replace culverts that create barriers to movement of juvenile and adult bull trout.	25	ODFW, USFS							

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Middle-Snake Geographic Region													
Powder River	All	Cons Rec		Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist.	Ongoing	USFWS, ODFW, USFS, Councils, BOR							
Powder River	B	Cons Rec		Increase information outreach to anglers.	Ongoing	ODFW, USFWS, USFS							
Pine/Indian/ Wildhorse	All	Cons Rec		Promote interagency collaboration and coordination on bull trout recovery actions by supporting existing bull trout working groups or the formation of new bull trout working groups where they do not exist.	Ongoing	USFWS, ODFW, USFS, Councils, BOR							
Pine/Indian/ Wildhorse	B	Cons Rec		Increase information outreach to anglers.	Ongoing	ODFW, USFWS, USFS							
Pine/Indian/ Wildhorse	A	Cons Rec		Restore shade and canopy cover provided by riparian vegetation along stream reaches where riparian habitats have been degraded.	25	**BLM**, councils, **landowners**, **NRCS,** ODFW, USFWS, **USFS**	Ongoing.						
Pine/Indian/ Wildhorse	A	Cons Rec		Assess causes of landslide on Lake Fork.	2	**USFS**							

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000) Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Pine/Indian/ Wildhorse	A	Cons Rec		Reduce grazing impacts.	25	**BLM**, councils, **landowners**, **NRCS,** ODFW, USFWS, **USFS**	Ongoing.						
Pine/Indian/ Wildhorse	A	Cons Rec		Assess mine sites for potential negative effects on bull trout and bull trout habitats and rehabilitate sites determined to be problems.	5	**ODEQ,** USFS	Cost estimate for evaluation of sites.						
Mainstem Columbia and Snake River FMO													
Mainstem Columbia and Snake FMO	All	Cons Rec		Insure coordination with Columbia River Federal Power System projects, FERC relicensing projects, and other large scale projects that require salmonid mitigation efforts.	Ongoing	States, USFWS Salmon Recovery Boards, Work Groups, NOAA, Tribes							
Mainstem Columbia and Snake FMO	All	Cons Rec		Transboundary planning should take into consideration both positive and negative impacts to migratory bull trout located upstream and downstream of mainstem dams.	Ongoing	States, USFWS Salmon Recovery Boards, Work Groups, NOAA, Tribes, and Canadian partners							

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Recovery Action Duration	Responsible Parties	Comments	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Mainstem Columbia and Snake FMO	A	Cons Rec		Reduce entrainment at large dams and diversions. Entrainment of adults and sub-adult bull trout occurs upstream and downstream at mainstem Columbia River and Snake dams and diversions. FERC relicensing and settlement agreements have reduced impacts to bull trout. Continued management and monitoring is necessary to maintain and further reduce the impacts from entrainment at large dams. Maintain and improve efforts to insure diversion screens are updated and functioning.	Ongoing	Corps,BPA, BOR, FERC, States, USFWS							
Mainstem Columbia and Snake FMO	A	Cons Rec		Maintain and improve water quality in the mainstem Columbia and Snake Rivers and meet water quality standards. Address 303d listed reaches for stream temperature.	Ongoing	Local, county and State governments. Corps, BOR BPA, EPA,							

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Appendix I. Summary of the Comments on the Draft Recovery Unit Implementation Plan for the Mid-Columbia Recovery Unit

Background

On June 4, 2015, we released draft recovery unit implementation plans addressing each the six recovery units that comprise the coterminous United States Population of bull trout for a 45-day comment period for Federal agencies, Native American Tribes, State and local governments, and members of the public. The public comment period ended on July 20, 2015.

This section provides a summary of general information about the comments received specific to the Draft Mid-Columbia RUIP (USFWS 2015b), including the numbers and breakdown of comments (letters from various sources).

We received 19 comment letters on the Mid-Columbia RUIP. Comment letters were received from the following sources:

Federal Agencies (4)

State Agencies (3)

Native American Tribes (1)

Utilities/Commissions/Counties/Cities (8)

Environmental/Conservation Organizations/Friends Groups (1)

Individuals (2)

Public comments ranged from editorial suggestions to providing new information. As appropriate, we have incorporated all applicable edits and suggestions into the text of the final Mid-Columbia RUIP. The following is a summary of substantive comments, and our responses to those comments and suggestions, that were either not incorporated into the Mid-Columbia RUIP or that were incorporated partially or fully but need additional explanation or justification. General or global comments pertaining to rangewide recovery issues for bull trout are addressed in Appendix D of the final recovery plan (USFWS 2015a).

1. *Comment:* One commenter pointed out that livestock are not the sole impact on riparian areas and waterways and that wildlife (*e.g.*, deer and elk) contribute negative impacts as well, even in areas that are fenced to exclude livestock. The same commenter also suggested the

Service overstated the threat of excess fine sediment and grazing in the Wallowa/Minam Core Area.

Response: We agree that wildlife can also contribute negative impacts to riparian zones. However, we have limited ability to predict when and where those impacts will occur and limited ability to manage those impacts relative to managing livestock. Although the draft RUIP identified impacts from grazing on stream habitats as a concern for the Wallowa/Minam Core Area, we did not characterize those threats as "primary" and thus only included actions as "conservation recommendations" not necessary for recovery. That said, we have modified the text in the grazing-related actions to indicate that livestock grazing is an issue of concern in some, but not all, areas in this core area.

2. *Comment:* Several commenters suggested that the Service should have included more information in the Mid-Columbia RUIP on conservation actions that have been accomplished and actions that are ongoing that benefit bull trout and bull trout habitat.

Response: We included a short section at the front of the Mid-Columbia RUIP that summarized significant ongoing conservation actions that contribute to bull trout conservation. Our intent with the recovery plan is to provide guidance on actions that need to either continue or be initiated to recover the species, not a comprehensive review of all actions that have been accomplished that may contribute to bull trout or bull trout habitat conservation.

3. *Comment:* One commenter suggested that bias and prejudice, and not science and monitoring, are being used to develop the recovery plan.

Response: We respectfully disagree with this assertion. The Service is committed to using the best available science and incorporating it into our recovery planning documents in a non-biased, objective fashion.

4. *Comment:* One commenter stated that if an agency is listed in the Responsible Parties column (Table C-3) a reader does not know if that listed agency(s) is part of a bull trout working group or the agency responsible for the action that is causing the threat.

Response: The narrative language preceding Table C-3 provides descriptions and definitions for the table's column headers, including for "Responsible or Participating Party". The description follows: *Organizations listed are those with responsibility or capability to fund, authorize, or carry out the corresponding recovery tasks. Organizations with broader jurisdiction across multiple core areas are listed first, followed by organizations specific to particular core areas.* ***Bolded type*** *indicates the agency or agencies that have the lead role for task implementation and coordination, though not necessarily sole responsibility.*

5. *Comment:* One commenter suggested identifying the best bull trout refugia using climate change models, ensuring connectivity between refugial populations in those core areas, and

focusing on reducing water temperatures to maintain year-round access between foraging, migration, and overwintering (FMO) habitat and spawning and rearing habitats by increasing habitat complexity in FMO habitat. A related comment by the USFS suggested the Service continue to monitor key bull trout habitat with temperature probes for current conditions and effects of climate change and to develop additional temperature monitoring locations that would contribute information for the NorWeST temperature database.

Response: We agree with these broad recommendations. A more thorough discussion of how climate change effects are considered in bull trout recovery can be found in the final bull trout recovery plan.

6. *Comment:* One commenter suggested that fisheries management across the Mid-Columbia RU, (including methods and timing of fish sampling, monitoring, and instream work) may constitute a primary threat in some core areas that have low abundance and that these actions should be reviewed and modified when such modifications could reduce impacts to bull trout.

Response: The Service identified fisheries management as a primary threat in very few core areas in the Mid-Columbia RU. However, we acknowledge that monitoring and evaluation, and instream work associated with restoration actions, can occasionally have negative impacts to bull trout and bull trout habitat. We actively work with our partners to minimize these affects through various means including informal and formal section 7 consultations under the Act with other Federal agencies, through our Section 10(a)1(A) recovery permit process, and through our section 6 agreements with States.

7. *Comment:* Multiple commenters suggested that the Service coordinate bull trout recovery with listed anadromous fish species (*i.e.*, salmon and steelhead) recovery in the Mid-Columbia and Lower Snake Geographic Regions.

Response: This comment is similar to others the Service received on this topic. Please see the Service's response under *General Comments* #4 in Appendix D of the recovery plan.

8. *Comment:* Several commenters suggested the Service consider reformatting the RUIPs to reduce redundancy and make them more user-friendly to those implementing on-the-ground actions. One suggestion was to organize the RUIPs by core area, where the primary threats, recovery narrative, and implementation schedule for each core area can be found in one place.

Response: Although we understand there are advantages and disadvantages to the format adopted for the RUIPs we did not change the format for the final recovery plan. For some partners and in some areas there may be advantages, following completion of the recovery plan, to create companion documents (*e.g.*, an action plan) that groups recovery related information by core area, geographic region or some other delineation.

9. *Comment:* One commenter recommended a tabular display accompany the description of the current status of bull trout in the Mid-Columbia RUIP such as the table provided in the Upper Snake RUIP.

Response: The Service was able to include a table that described the current status of bull trout in the Upper Snake RUIP because that information was available, in large part from the State-wide assessment conducted by the State of Idaho. That type of broad assessment was not available for bull trout in the Mid-Columbia RUIP and thus we were unable to present that type of information.

10. *Comment:* One commenter stated that due to climate change, predatory species such as smallmouth bass in FMO areas of the lower North Fork John Day River are an emerging threat.

Response: We agree that climate change will likely lead to seasonal expansion of smallmouth bass upstream in the John Day River. However, there is significant uncertainty as to what effects this will have on bull trout given that seasonal stream temperatures will continue to limit overlap and interactions between these two species. The Service does not believe that the threat of smallmouth bass is consistent with our definition of a primary threat.

11. *Comment*: One commenter stated that the description of habitat primary threats for the North Fork John Day River didn't identify legacy and current threats such as timber harvest, forest roads, lack of large wood, functioning floodplains, loss of habitat complexity in FMO habitat, and connectivity between FMO and spawning/rearing habitat.

Response: We mistakenly omitted Forest Management in the description of primary threats for bull trout in the North Fork John Day River and we have incorporated this edit. However, there are actions in the Recovery Measures Narrative to address legacy and current effects of Forest Management and transportation networks. Additional actions in the recovery measures narrative address other threats identified in this particular comment such as large wood, floodplain function, habitat complexity, and connectivity between FMO and spawning/rearing habitat.

12. *Comment*: One commenter commented that climate change should be identified as a primary threat in many of the Mid-Columbia Recovery Unit core areas, particularly in the Tucannon, Asotin, and Imnaha core areas.

Response: We agree that climate change will exacerbate existing threats to bull trout and some bull trout populations will be more vulnerable than others to these threats. The overall recovery strategy for bull trout is to effectively manage threats through actions that reduce and minimize these threats. As such we have chosen to not identify climate change as a primary threat and instead identify existing threats that rise to the level of a primary threat under the pressures of climate change and subsequent actions to effectively manage those threats. A more thorough discussion of how climate change effects are considered in bull trout recovery can be found in the final bull trout recovery plan and in Appendix D of the final plan.

13. *Comment*: Multiple commenters suggested the operation of the Imnaha River and Lookingglass Creek weirs in NE Oregon do not constitute a primary threat to bull trout and that monitoring and evaluation of the effects of these weirs on bull trout should not be categorized as priority 1 actions.

Response: While the Service is concerned that the recent spate of mortalities of adult bull trout observed at the Imnaha Weir may be linked to handling or passage delay at the weir, we agree that there is significant uncertainty as to the cause of mortalities observed. We also agree that even if the weir is the source of the mortalities observed, the threat likely does not rise to the level of a primary threat, as defined, given the relatively healthy status of bull trout in this core area and the length of time this weir has been in operation. Similarly, the Lookingglass Creek weir does not meet the definition of a primary threat if we look at how this issue is assessed across this and other recovery units. Given that we are removing the Imnaha and Lookingglass weirs as primary threats in the Mid-Columbia RUIP it is logical that the priority for assessing the impacts of these weirs on bull trout also be revised from a 1 to a 3. These edits have been incorporated into the Mid-Columbia RUIP.

14. *Comment*: Several comments were provided pertaining to fish passage at BOR facilities in the lower Umatilla River, specifically that they are not aware of any bull trout passage issues and that several passage-related actions (2.1.2 and 2.1.3) in the recovery measures narrative and implementation schedule should be removed.

Response: Although we are aware adult bull trout have been documented migrating past these facilities, an evaluation has not been conducted to determine the overall effectiveness of these facilities for not just adult bull trout but also juvenile and subadult bull trout which may seasonally use the lower Umatilla River. In addition, information discussed at our interagency RUIP meeting suggested that modifications to the fishway at Feed Canal Dam may be necessary to effectively pass bull trout and other salmonids. For these reasons we are retaining action 2.1.2. We agree with the comment regarding passage at Three Mile Dam and thus will remove action 2.1.3 from the Recovery Measures Narrative and the Implementation Schedule.

15. *Comment*: Several commenters suggested that water quality and quantity issues in the mainstem Grande Ronde River are likely not a limiting factor for the Lookingglass Creek population of bull trout since those fish that migrate to the Grande Ronde likely do so in late fall and winter when water quality and quantity are improved.

Response: We agree with this comment and thus have revised the text accordingly and moved it to a conservation recommendation.

16. *Comment*: One commenter suggested that additional actions be added to the Ongoing Conservation Measures Summary for the John Day, Tucannon, and Asotin core areas.

Response: We have modified the text accordingly.

17. *Comment*: One commenter suggested several actions for the North Fork John Day core area that would promote beaver recolonization in order to promote restoration of watershed processes important to water retention, sediment sequestration, cold water storage, and floodplain connectivity, all of which would support the creation and maintenance of habitat for bull trout and other native fish.

Response: The Service supports this suggestion and has incorporated the actions into the Recovery Measures Narrative and Implementation Schedule.

18. *Comment*: One commenter commented that the Service should include actions to improve water quality in the Walla Walla River.

Response: Many of the actions we included under 1.2, Instream Impacts will contribute directly and indirectly to improving water quality in the Walla Walla River.

19. *Comment*: Several commenters pointed out that in the draft RUIP for the Mid-Columbia that there were many actions categorized as Priority 1 that, by definition, should be Priority 2 or 3. It was further stated that in most core areas the score of 1 should be rare and that core areas that are relatively healthy should not need any actions rated as Priority 1 or 2 (unless the threat is new).

Response: We agree with this comment and have reviewed priority numbers for consistency and appropriateness across the Mid-Columbia Recovery Unit.

20. *Comment*: One commenter stated that Fisheries Management should be added as a primary threat for the Tucannon Core Area because of large numbers of anglers that use the Tucannon River to fish for trout and steelhead.

Response: Discussions of threats for bull trout in the Tucannon Core Area occurred during stakeholder meetings and it was generally felt that recreational angling, while potentially impacting individual fish, did not rise to the level of a primary threat for local populations or to bull trout at the core area scale.

21. *Comment*: One commenter suggested that Small Population Size should be included as a primary threat to bull trout in the Touchet Core Area.

Response: During RUIP stakeholder meetings, small population size was not considered a primary threat in the Touchet Core Area. The Service's working definition for small population size is local populations that contain fewer than 100 spawning adults or approximately 17 redds per year. Local populations below this threshold are at risk from inbreeding depression. Existing redd survey data for the Touchet Core Area indicates that 2 of the 3 local populations exceed 25 redds annually and in most years are above 50 redds. Therefore, small population size is not considered a primary threat in the Touchet Core Area.

22. Comment: One commenter suggested the Salmo Core Area should be part of the Columbia Headwaters Recovery Unit, not the Mid-Columbia Recovery Unit.

Response: The Salmo Core Area remains in the Mid-Columbia RU. None of the bull trout core areas included in the Columbia Headwaters RU have ever coincided with anadromous salmon or anadromous salmon life histories. Salmo River bull trout, however, historically coincided with anadromous steelhead and potentially chinook. This is based on the presence of native redband trout existing within the core area. In addition, Dunham et al (2014) assessed the historical and genetic connectivity of bull trout between the Lake Pend Oreille Core Area and Salmo River populations. The assessment determined that upstream gene flow of Salmo River populations with those in the Lake Pend Oreille likely did not occur due to historical natural barriers that limited upstream migration of bull trout.

23. *Comment*: One commenter suggested the following recovery measure be added for the Salmo Core Area: 2.2.3 Seattle City Light and partners will provide upstream passage at Boundary Dam. Provide safe, timely and effective fish passage at Boundary Dam consistent with the Boundary Settlement Agreement.

Response: Passage in the mainstem Pend Oreille River was not identified as a threat to the Salmo River Core Area. Historical and genetic data indicates that connectivity with core areas upstream was not a significant factor in the persistence of the Salmo Core Area populations (Dunham et al 2014). While passage at Boundary Dam may be an element of the Seattle City Light settlement agreement, it does not address a primary threat for the Salmo River Core Area. We therefore did not adopt the recommendation.

24. *Comment*: One commenter suggested the following recovery action be added to the Mid-Columbia RUIP: 2.2.4 Seattle City Light and partners will reduce entrainment mortality at Boundary Dam. Seattle City Light will develop entrainment reduction strategies to reduce or eliminate loss of individuals over Boundary Dam.

Response: Comment noted. Entrainment of bull trout over Boundary Dam does not address identified threats to bull trout in the Salmo Core Area. However, entrainment over Seven Mile Dam does have a detrimental impact on bull trout. Therefore, a new task was added - Task 2.2.3. Trans-boundary partners will work together to minimize or eliminate entrainment over Seven Mile Dam. This task was added to the Implementation Schedule. Costs are to be determined and will come from Canadian partners.

25. *Comment*: One commenter stated that incidental catch of bull trout in the Lost River and Methow may be negatively impacting bull trout and that this threat should be monitored more closely.

Response: We have identified fish management as a threat and the task is addressed in task 2.2.1 and 4.2.3 in the Recovery Measures Narrative for the Methow.

26. *Comment*: One commenter suggested the Service develop a funding mechanism to allow for basic population monitoring (*i.e.*, redd surveys) in the Upper Columbia and in particular the Methow Subbasin.

Response: The Service agrees with this suggestion. As a result we included a new recovery task for developing a funding mechanism for the areas within the Upper Columbia Geographic region.

27. *Comment*: One commenter restated comments submitted on the draft recovery plan concerning: a) geographic scale; b) proposed recovery criteria and evaluation process; and c) lack of a clear path for monitoring and adaptive management.

Response: Comments a), b), c), are addressed in Appendix D of the recovery plan under the Global Comments such as geographic scale of recovery units, recovery criteria and evaluation, and monitoring and adaptive management. These are summarized and addressed in multiple places in Appendix D of the final recovery plan.

28. *Comment*: One commenter questioned the threat categories used for the Mid-Columbia RUIP.

Response: Threats categories remain similar across all recovery units and RUIPs. We updated the Mid-Columbia RUIP threats categories with a list of sub-categories that fall under each of the major threats headings. For example, the heading of Upland/Riparian Land Management now includes several other sub-categories in the Methow (*i.e.*, agriculture, Livestock Grazing, Forest Management, Development, transportation networks, and recreation) where it only listed legacy timber harvest, roads, water, and temperature in the draft. These updated subcategories should link to previously listed threats and are similar in nature to threats for salmon recovery planning. A recovery plan is meant to be updated with local knowledge through time and further clarification and updates can be coordinated with the Service and other partners in local bull trout action plans or other watershed planning efforts.

29. *Comment*: One commenter stated that information on abundance levels for the Yakima Core Area was incomplete and some values were inaccurate. Additional information was provided by the commenter.

Response: Demographic information is from the Yakima Action Plan. We appreciate the additional redd data. We updated this section, which is intended to be a general description. We include the number of local populations as we have described them in the action plan and past status reviews. Without new genetics information we don't have enough information to lump or remove populations (*i.e.*, Upper Yakima). The upper Yakima population is not included in the Yakima genetics baseline due to lack of samples collected on these fish. It is premature to say if they are otherwise similar to other populations in the basin. Adults, redds, and juveniles have been observed between Easton Dam and Keechelus Dam, and habitat is complex and temperatures do reach spawning temperatures. Future sampling may determine population status.

30. *Comment*: One commenter provided the following technical comments pertaining to bull trout in the Methow River: 1) Primary threats should be truly primary threats and you can remove the general needs; 2) Threat severity is presented without support; 3) stocking native species will help bull trout, stocking is already quite common, brook trout removal should be explored after distribution is known; 4) hatchery fish are likely benefiting bull trout, large predators don't include lake and brown trout.

Response: As the action plan is developed the threat categories and condition will be further refined. This is the list that most partners thought should be included and further assessed during the more local action planning process. We acknowledged in task # 2.2.2 that native stocking occurs and should continue. We added language to clarify the continued development of a feasibility assessment for brook trout removal, and that the monitoring of non-native predators in the FMO in the Columbia River and lower Methow should occur into the future. Brown trout and pike are on the rise in the Columbia River. Pike have been found in Lake Roosevelt. The impact from hatchery fish and associated monitoring is described in the Biological Assessment process with NOAA for the issuance of their section7 consultation. Monitoring will be developed during that consultation and actions will be an important part of bull trout recovery.

31. *Comment*: One commenter pointed out that bull trout in Lake Chelan are considered extirpated, that effective recovery is unrealistic, and that viability should not be relevant for delisting.

Response: We added narrative in Appendix II describing the potential role of Lake Chelan and Okanogan FMO in recovery. While we acknowledge that reintroductions into historical core areas may contribute to recovery in the future, the Service has not established general guidelines or criteria for determining when a reintroduced population would be considered viable for recovery.

32. *Comment*: One commenter commented that PUD data and the Service's Fisheries Resource Office (Leavenworth, Washington) data collected over the last 10 years does not point to the general bull trout declines mentioned in the Mid-C RUIP. The commenter further stated that the draft RUIP used unpublished redd counts and personal communications in the appendix

to support these statements of general bull trout decline and that this was a concern.

Response: The Service's Leavenworth Fisheries Resource Office maintains redd count data that was used in the last bull trout 5-year review. Typically redd counts are used to substantiate numbers of bull trout by core area. There are multiple populations from numerous core areas using the mainstem Columbia River. The narrative portion of the recovery plan is intended to be a general description. When an action plan is developed post-recovery plan, distribution and numbers of individuals can further be described with new information.

33. *Comment*: One commenter commented that from data that the PUD's have seen, the Entiat, Methow, and Wenatchee core areas are strongholds with superior connectivity. The commenter suggested adding dam window counts and data collected in various PUD/ USFWS Fisheries Resource Office reports.

Response: Connectivity between the core areas and Columbia River is functioning with implementation of FERC relicensing and consultation. Typically redd counts are used to substantiate numbers of bull trout by core area. There are multiple populations from numerous core areas using the mainstem Columbia River. The narrative portion of the recovery plan is intended to be a general description. When the action plan is developed post-recovery plan, distribution and numbers of individuals can further be described with new information.

34. *Comment*: One commenter provided the following: effective monitoring programs are needed to determine whether recovery actions for bull trout are successful and to help determine where and when recovery criteria have been achieved. Monitoring may include assessing distribution, population status, life history, migratory movements, and genetic characteristics of bull trout in each recovery unit. In addition, evaluating monitoring efforts, management practices such as those for water diversion screening, grazing, timber harvest, and riparian management should be evaluated for their effectiveness in reducing impacts on bull trout. For example, the identification of core areas and watersheds within the Mid-Columbia Recovery Unit that are most likely to maintain habitats suitable for bull trout over the foreseeable future under probable climate change scenarios will also help guide the allocation of bull trout conservation resources to improve the likelihood of success."

Response: The development of the bull trout action plan can include the specific information the commenter would like to see addressed. Redd data has been used across the range for monitoring bull trout populations. Mainstem data has not been critical for determining numbers in each core area, but has been important in evaluating distribution. We did include the BioAnalyst, Inc. literature citation that captures most of the work in the mainstem. Additional information can be incorporated in the action plan to be developed post-recovery plan. Currently, the Service is working with WDFW to develop a pilot study to look at redd data and expansion factors. The future action plan can incorporate this information as well.

35. *Comment*: One commenter stated that entrainment and connectivity/fish passage specific to hydropower dams on the Columbia is speculative.

Response: We have Federal Energy Regulatory Commission relicensing and Endangered Species Act Section 7 consultations that describe take and impacts to bull trout at mainstem dams. These impacts will continue into the future for the life of the license. The threat is ongoing and monitoring will occur into the future. Downstream impacts to bull trout and impacts to subadults are largely unknown and the radio telemetry work occurred only for adults. Entrainment and connectivity impairment from mainstem dams will remain a threat into the future and can be further described in a post-recovery plan action plan.

36. *Comment*: One commenter stated that redd count data should not be used as an index for bull trout status due to factors such as human error, fish spawning outside index reaches, redds being misidentified, changes in seasonal spawning timing, etc. The commenter suggested improving datasets by using electrofishing, weir trapping, and dam window counts.

Response: Due to differences between salmon and bull trout, redd surveys are typically more acceptable to fisheries managers than electrofishing, weirs or traps for monitoring populations, and they will likely continue to be used as an important monitoring tool. Surveys of index reaches are generally accurate for most areas, but they may not fully represent total distribution or abundances. The Service is working with WDFW in developing a pilot study to develop expansion factors and to resurvey index reaches.

37. *Comment*: One commenter asked how the Service will work with partners in each core area.

Response: A tool such as the Threats Assessment Tool described in the recovery plan or equivalent will be used to help assess whether threats are being adequately managed. In the Yakima, the post-recovery plan action plan will be the link to the Service's recovery plan. We can update the action plan to include a communication strategy.

38. *Comment*: One commenter suggested that the Yakima Core Area threat and action descriptions should be clarified and consolidated.

Response: The Service agrees there are pros and cons to the current format of the RUIPs and several commenters have suggested ways to reformat the RUIPS for clarity. In developing more localized action plans that would tier to the final bull trout recovery plan we will have the opportunity in the future to consider the format suggestions and the specificity requested by the commenter.

39. *Comment*: Several commenters suggested that the process for refining and updating the Mid-C RUIP and completing the associated core area threats assessment should be described in the Mid-C RUIP.

Response: This comment was also received for other recovery units and thus a response was developed in Appendix D of the main recovery plan. See the response for General Comment #5.

40. *Comment*: One commenter stated that the Mid-Columbia RUIP doesn't describe the relationship between action plans and RUIPs.

Response: The recovery measures narrative and recovery implementation table includes a task to maintain the Yakima Bull Trout Technical team and to update an action plan over time. The goal is to have a local action plan for the Yakima Core Area that would tier to the RUIP and overall recovery plan but would include specificity lacking in the Mid-C RUIP.

41. *Comment*: One commenter commented that the plan lacks a quantitative framework for analysis and doesn't include a clear threat ranking or analysis process. There is no plan to measure success and no formula for survival and birth rates, migration rates, and growth rates; the relationship to these rates is not described. Threats tool should address population functions.

Response: We consider these comments as global comments and as such they are addressed in Appendix D of the recovery plan, under general comments and recovery plan strategy and criteria. Bull trout are difficult to monitor and life models have not been developed for bull trout.

42. *Comment*: One commenter commented that the plan goes astray by ignoring a quantitative assessment provided in Rimrock Reservoir identifying the small amount of headwater rearing habitat for bull trout as a limiting factor and showing passage would not have an effect.

Response: For a metapopulation to function, connectivity among its local populations must be achieved. The Yakima has only two or three of its populations at a level thought necessary to maintain distribution and genetic integrity within the core area. The largest populations currently are not connected. Passage into Rimrock Reservoir will be assessed and prioritized with ongoing fish passage plans. The local bull trout action plan will be the source for this specific information and refined prioritization of tasks. Nursery habitat enhancement is proposed within the habitat actions mentioned on USFS lands.

43. *Comment*: One commenter stated that the local bull trout action plan should be used to develop the list of threats and also to guide recovery measures.

Response: We agree. The Yakima Bull Trout Action Plan was used to identify threat sub-categories and actions. The Action Plan was also used to develop general information in the RUIP for the Yakima about populations, condition of the threat, etc.

44. *Comment*: One commenter asked how the Service will assess condition of threats in the future. The commenter suggested adding more detail to the Recovery Measures Narrative.

Response: The Yakima Bull Trout Action Plan includes a table with life stages and a ranking table for each threat. It needs updating but along with the recovery plan's threats evaluation tool the action plan will help the Service determine the condition of the threats. It is expected that the Yakima Bull Trout Action Plan will be the place for additional details for recovery tasks.

45. *Comment*: One commenter stated there should be stronger rationale for threats and recovery measures so that there is a clear link between recovery actions and expected benefits to bull trout populations.

Response: The Yakima Bull Trout Action Plan provides a table for the condition and ranking of the threats. We expect that locally this will be maintained so we can use it along with future 5-year status reviews for bull trout where a summary of analysis is developed and shared.

46. *Comment*: One commenter suggested the Service implement the threats assessment during RUIP development rather than after the recovery plan is completed.

Response: The intent of the threats assessment tool, as described in the bull trout recovery plan, is for it to be implemented as warranted following completion of the recovery plan.

47. *Comment*: One commenter suggested that the RUIP Implementation Schedule provide more specificity in regards to recovery actions.

Response: There were several meetings in the Yakima Basin where people were invited to participate in providing comments or data prior to publishing the RUIP. There is opportunity to be involved in the development and refinement of action plans at the local scale. The Yakima Bull Trout Action Plan provided the specifics and details in its projects list.

48. *Comment*: One commenter stated that the Mid-C RUIP does not incorporate the information contained in the Yakima Bull Trout Action Plan and would fail the Administrative Procedures Act.

Response: Information presented in the RUIP on Yakima bull trout includes the threats list, priorities, and other information from the Yakima Bull Trout Action Plan. We specifically worked with individuals that wanted to share new information, most with the Yakima Technical Group and Yakima Basin Fish and Wildlife Recovery Board, to gather the best scientific information. There is a recovery implementation task to continue to use the technical group and the action plan to develop local information. The Service worked on the development of the Action Plan so that it would link to a larger scale recovery plan document. It is designed to be the local watershed plan with the best scientific information for recovery of bull trout.

49. *Comment*: One commenter suggested the Service revise text from the Yakima Core Area section of the Mid-C RUIP regarding how barriers are characterized (*i.e.*, BOR did not build

"migration barriers". The commenter also suggested acknowledging the ongoing cooperative work in the basin directed at fish passage.

Response: The Ongoing Actions section of the RUIP describes that there is ongoing work as part of the BOR's ongoing maintenance and operations of the Yakima Irrigation Project. We added the narrative to reword it to make more sense and generally address ongoing work.

50. *Comment*: One commenter requested that the statement in the RUIP "Entrainment at all mainstem BOR dams and screening at other diversions kills or injures bull trout…" needs to be removed.

Response: The BOR dams in the Yakima Basin have been found to entrain bull trout, based on data from the BOR, CWU, and the genetics baseline analysis by WDFW. Data from the BOR show that bull trout prey are also entrained. We do not feel this is an inaccurate statement that needs to be removed.

51. *Comment*: One commenter submitted multiple comments pertaining to natural resource management (grazing, stream restoration, land ownership) in the three John Day River Basin core areas. Many of the comments focused on, and objected to, monitoring standards for grazing that were recommended in the Mid-C RUIP, and on the limited responsibility of the BLM in regards to floodplain, riparian, and stream channel restoration due to their limited land ownership in these three core areas.

Response: The Service's RUIP meetings in the John Day Basin and in other locations in eastern Oregon involved many BLM and USFS personnel that administer and monitor Federal lands grazing programs as well as biologists from the Service and other agencies that are knowledgeable about these programs. From these meetings we developed broad recommendations for grazing standards and monitoring protocols that were generally advised and supported by a wide diversity of participants. Because of the broad support for these guidelines we decline to modify them per BLM comments. We want to be clear that guidelines in recovery plans are just that: guidelines. Recovery plans are not regulatory documents and the recommendations within are discretionary and nonbinding.

In regards to numerous requests within the comments to remove or un-bold the BLM as a responsible party for various recovery actions, we have made all of those suggested edits in the Implementation Schedule.

52. *Comment*: One commenter stated that the draft Mid-C RUIP improperly identified the Rocky Reach, Rock Island, and Lake Chelan hydroelectric projects, and the non-powered Tumwater and Dryden dams, as blocking or impeding bull trout migration. They commented that Chelan County PUD facilities successfully and timely pass upstream and downstream migrating bull trout and do not interfere with essential behaviors or limit bull trout recovery.

Response: We have used general information to describe threats and actions with the understanding that a local watershed/action plan will develop the specific information (*i.e.*, Yakima Bull Trout Action Plan) and incorporate specific information and references. FERC relicensing addresses ongoing impacts so as not to jeopardize bull trout. The impacts from that ongoing project were assessed and are minimized or reduced with terms and conditions in the Service's biological opinions (section 7 consultation process) but minimization of impacts don't fully remove the threat. The bull trout management plans also assist with addressing continued concerns identified in the biological opinion analysis. We appreciate the continued effort by Chelan County PUD, including the monitoring, which will continue to reduce impacts. As assessed in the biological opinions, structures on the ground in bull trout habitat harm individuals from multiple populations that are moving both upstream and downstream throughout the project facilities. We agree that the District has reduced the threat substantially and into the future, but impacts and take still occur on the ground in critical habitat and to the bull trout. Lake Chelan is listed as a historic core area because it is functionally extirpated, but the watershed retains potential to contribute to recovery. Local action planning will further describe threats and potential actions that could be taken to improve it as a potential future core area for restoring native fish assemblages and potentially as rescue habitat as climate change advances. While we consulted with FERC on the Chelan Hydroelectric Project with a "not likely to adversely affect" determination, that conclusion does not preclude the recovery plan from discussing the potential contributions of Chelan recovery actions to meeting recovery goals. Threats listed here are in relationship to the potential to restore bull trout as further described in a local action plan, and the RUIP provides a starting point. Some language has been changed in the narrative to reflect this.

53. *Comment*: One commenter stated that the Service excluded recent scientific research reports on bull trout in Mid-C Recovery Unit, particularly in the Upper Columbia Geographic Area.

Response: The RUIP references the final BioAnalyst report (BioAnalysts, Inc 2004) and Stevenson *et al.* (2009). Population trend information is generally provided by redd survey data, while telemetry or movement data aid in describing distribution. The development of the local action plan for the Upper Columbia Geographic Area will include specificity regarding threats and movements, and survey and telemetry reports will be essential in that process.

54. *Comment*: One commenter pointed out that the Service failed to utilize information from a Service-written report (Nelson 2012) regarding the extirpation of bull trout from Lake Chelan. In particular the commenter noted that none of the hypotheses for extirpation considered in the report pointed towards entrainment or passage problems at the Chelan River Hydroelectric Project.

Response: Nelson (2012) is referenced in the RUIP. This report summarizes historical information related to fisheries management and disease in Lake Chelan, and hypothesizes what may have happened to bull trout but does not provide definite conclusions. Although Lake Chelan is not known to currently support a bull trout population, it may provide a cold water refuge during climate change. We modified the narrative, threats, and tasks to reflect some of the commenter's concerns and the information provided.

55. *Comment*: One commenter requested the Service clarify and define the term "entrainment" or, preferably, use an alternative word to describe downstream passage at dams or hydropower projects where there is no entrapment of fish and adult fishways are present and used by migratory bull trout.

Response: The general categories of threats are described in the recovery plan. Entrainment is defined in the Glossary of Terms as: *The process by which aquatic organisms are pulled through a diversion, turbine, spillway, or other device.*

56. *Comment*: One commenter suggested a number of recovery actions for bull trout recovery in the Yakima Basin to offset the impacts of future climate change such as bull trout supplementation, augmentation, translocation to areas above natural barriers, and nutrient supplementation.

Response: The Mid-C RUIP mentions using climate change scenarios to further evaluate core areas and other areas for recovery of bull trout. While the Mid-C RUIP has a section that discusses climate change as it relates to impacts to bull trout, we also refer the reader to the description of climate change impacts in the main recovery plan. In response to this comment we added language in the threats table under Instream Impacts at the subcategory of Climate Change to reflect lower elevation spawning and rearing areas in the Yakima and other core areas.

57. *Comment*: One commenter stated that the Mid-C RUIP provided uneven treatment and detail regarding ongoing recovery actions to benefit bull trout in central and eastern Washington.

Response: The Ongoing Conservation Measures section has been updated to reflect this comment and similar comments from other reviewers.

58. *Comment*: One commenter stated that the Mid-C RUIP inaccurately characterizes all agricultural threats as part of the Yakima Irrigation Project and does not clearly distinguish between connectivity impairment associated with water quality impacts and those created by flow alteration and irrigation infrastructure.

Response: We have left the sub-heading the same. Specifics can be addressed in the action plan. We did update the threat table with some of the language provided in the comment.

59. *Comment*: One commenter stated that the Mid-C RUIP contained little direction regarding recovery measures for flow-related threats to bull trout in the Yakima Core Area.

Response: The RUIPs were developed in a general structure. Further details of how to address the specific threats to bull trout in the Yakima Core Area can be further outlined and developed in the action plan. We recommend BOR add these actions to the Yakima Action Plan and update the plan to include revising winter flows, assessing water availability, and assistance in watershed planning to improve instream flows.

60. *Comment*: One commenter pointed out that the mainstem Columbia River FMO was not included in Table C-2, Threats to Bull Trout in the Mid-C Recovery Unit, nor was it included in the Recovery Measures Narrative or Implementation Schedule.

Response: We agree that this was an oversight. The revised Mid-C RUIP has incorporated the mainstem Columbia River FMO, as well as the mainstem Snake River FMO segments into the Threats Table (Table C-2), the Recovery Measures Narrative, and the Implementation Schedule. The recovery actions identified in this FMO area are largely concordant with work being accomplished through salmon recovery planning processes.

Appendix II. Summaries of Mid-Columbia Recovery Unit Core Areas, Mainstem FMO Segments, Historic Core Areas, and Research Need Areas

Note: This appendix contains brief summaries for most but not all core areas in the Mid-Columbia Recovery Unit.

<u>Lower Mid-Columbia Geographic Region</u>

John Day River Basin Introduction

The John Day River is the fourth largest drainage basin in Oregon, consisting of the Upper Mainstem, North Fork, Middle Fork, and South Fork rivers. The 20,979 square km (8,100 square mile) river basin contains more than 804 km (500 miles) of stream in the Upper Mainstem and its three forks and the John Day River is one of the longest free-flowing streams in the continental United States. The mainstem, Middle and North Fork Rivers, constituting the three core areas in this basin, originate in the Blue Mountains, and the South fork originates in the Ochoco Mountains. The mainstem originates southeast of the community of Prairie City and flows west through the communities of John Day and Dayville where it is joined by the South Fork. Downstream from Dayville, the river turns north through Picture Gorge and continues on to the community of Kimberly, where it joins with the North Fork. From a bull trout use standpoint, from this point downstream to the Columbia River is considered mainstem FMO habitat that is utilized seasonally. The division between the upper mainstem John Day River and lower John Day River occurs at the confluence of the North Forth.

Agriculture is the main land-use practice effecting bull trout in the mainstem John Day River. A high number of push-up dams, unscreened irrigation diversions and livestock grazing occur within bull trout habitat. These land-use practices result in intermittent passage, and interrelated impacts such as sedimentation, reduced flows, channel alteration and associated water quality impacts (NPPC 2001a). Although numerous passage improvement projects have been implemented over the last decade, many issues persist, especially in the mainstem John Day River.

North Fork John Day Core Area

The largest tributary to the John Day River is the North Fork John Day River which originates in the Elk Horn Mountains at approximately 2,440 meters (8,000 feet) in elevation. From its source, the North Fork John Day River flows primarily west for 188 km (117 miles) where it joins the mainstem John Day River at an elevation of approximately 1,007 meters (3,300 feet) near the town of Kimberly. The North Fork John Day River watershed consists of approximately 155,351 hectares (ha) (383,582 acres). The Middle Fork John Day River flows into the North Fork upstream of the town of Monument, about 50 km (31 miles) before the confluence of the North Fork with the mainstem. The North Fork is included in the Oregon Scenic Waterways and National Wild and Scenic River systems from the North Fork John Day wilderness boundary to river km 32.5 (river mile 20.2) above the town of Monument. Major tributaries to the North Fork include Desolation and Granite Creeks. The primary land uses include agriculture, timber production, mining, and recreation.

Seven local populations have been identified in the North Fork John Day River Subbasin: (1) upper North Fork John Day River including Crawfish, Baldy, Cunningham, Trail, Onion, and Crane Creeks as well as the North Fork John Day River upstream of Granite Creek; (2) upper Granite Creek including Bull Run, Deep, and Boundary Creeks and the upper mainstem Granite Creek); (3) Boulder Creek; (4) Clear/Lightning creek including Salmon Creek; (5) Clear Creek below the Pete Mann ditch (including Lightning Creek below the ditch), (6) Desolation Creek (includes South Fork Desolation Creek below the falls and North Fork Desolation Creek); and (7) South Fork Desolation Creek above the falls. Based upon inventories conducted in 1992, bull trout distribution in the North Fork John Day River and tributaries was limited to 18 percent of the previously known range (Claire and Gray 1993).

Resident bull trout are the predominant life history form in the North Fork with a few fluvial migratory individuals documented in recent years. There is limited data available for the local populations in this core area. Redd counts have been conducted in the upper mainstem North Fork and Baldy Creek. Recent redd counts in Baldy Creek show a downward trend in redd abundance. The North Fork has been described as the most challenging area to identify bull trout redds in Oregon based on the decomposing granite gravel substrate and extensive hybridization with brook trout. One priority for the John Day Basin is to develop a system to monitor bull trout presence and population trends.

In addition to the limited redd count data, researchers from Utah State University initiated bull trout research in the North Fork John Day River in 2005. Population estimates for the North Fork John Day River showed low abundances of bull trout in the mainstem of the North Fork and in Baldy Creek (1,000 each for both). Due to limited distribution of bull trout below the confluence with Baldy Creek, in 2006 researchers focused population surveys above the Baldy Creek confluence. In 2006, researchers from Utah State University estimated the population of bull trout greater than 120 mm (5 inches) in the upper North Fork John Day above the Baldy Creek confluence at 432 individuals (95 percent confidence interval = 274 to 752) and 1,193 individuals in Baldy Creek (95 percent confidence interval = 825 to 2509) (Budy *et al.* 2005; Budy *et al.* 2006).

Middle Fork John Day Core Area

The Middle Fork John Day River originates approximately 16 km (10 miles) east of Austin Junction at an elevation of approximately 2,242 meters (7,350 feet) and flows west for 121 km (75 miles) before it enters the North Fork, 50 km (31 miles) upstream of the town of Kimberly (Oregon Water Resource Department 1986). The Middle Fork John Day watershed consists of approximately 83,257 ha (205,572 acres). The section from the Crawford Bridge crossing to the confluence with the North Fork is included in the Oregon Scenic Waterways system. A total of 343 km (213 miles) of fish-bearing streams occur in the upper Middle Fork John Day River and Galena watersheds. The primary land uses include agriculture, timber production, mining and recreation.

There are currently three local populations in the Middle Fork John Day Core Area: Granite Boulder, Big, and Clear Creeks. Recent sighting of bull trout in Vinegar, Butte, Big Boulder and Bridge Creeks have been reported although spawning and early juvenile rearing in these streams is uncertain.

Bull trout in the Middle Fork John Day River persist at low abundance levels. Resident bull trout are the predominant life history form. In 1999, population surveys were conducted in Clear, Big, Deadwood, and Granite Boulder Creeks to estimate abundance. Total numbers of bull trout consisting of primarily juvenile and subadult fish were estimated to be 1,950 individuals in Big Creek, 640 individuals in Clear Creek, and 368 individuals in Granite Boulder Creek (Hemmingsen 1999). In 1999 and 2000, redd surveys were conducted on Clear Creek and eight redds were observed each year (Malheur National Forest 2001).

From 2002 to 2004, the ODFW Native Fish Investigations Project conducted a pilot study assessing the feasibility, precision, and accuracy of the Environmental Monitoring and Assessment Protocol (EMAP) for estimating bull trout redd abundance. Redd abundance estimates in the Middle Fork John Day River Basin ranged from 42 to 192. (Sankovich *et al*. 2003; Sankovich *et al*. 2004; Starcevich *et al*. 2005). In 2005, a census count was conducted in the mainstem Middle Fork and 25 redds were reported. In the absence of long-term monitoring, the data on bull trout local population sizes is limited.

A priority for the Middle Fork John Day core area is to establish a monitoring system to enumerate adult abundance. Currently, Big Creek is used as an index reach to conduct redd surveys but the index reach is located above an impassible waterfalls so the index numbers does not include fluvial fish.

Upper Mainstem John Day River Core Area

The John Day River is the fourth largest drainage basin in Oregon, consisting of an Upper Mainstem, North Fork, Middle Fork, and South Forks Rivers. The 20,979 square km (8,100 square mile) river basin contains more than 804 km (500 miles) of stream in the mainstem and its three forks and the John Day River is one of the longest free-flowing streams in the continental United States. The mainstem originates southeast of Prairie City and flows west through the communities John Day and Dayville where it is joined by the South Fork. Downstream from Dayville, the river turns north through Picture Gorge and continues on to the community of Kimberly, where it joins with the North Fork. The division between the upper mainstem John Day River and lower John Day River occurs at the confluence of the North Forth John Day River. The primary land uses include agriculture, timber production, mining and recreation.

Currently, there are two local populations in this core area: 1) Upper Mainstem John Day River, which is located primarily above the town of Prairie City; and 2) Indian Creek. Indian Creek is likely an isolated population. There could be interchange between the Middle Fork, North Fork, and Upper Mainstem John Day Rivers except in summer months due to low flows and high water temperatures. There are still some isolated passage issues and Indian Creek is seasonally dewatered. There is no information to suggest presence of local populations in other tributaries. There is potential for the establishment of a local population in Dixie Creek and for expansion of distribution to additional areas within Indian Creek. Recently a bull trout was observed in the South Fork John Day River, most likely utilizing this river for foraging.

The bull trout in this core area express both a resident and fluvial life history strategy (Hemmingsen et al. 2001). There is little information on bull trout abundance in the Upper Mainstem John Day River, although this core area may be a bull trout stronghold in the John Day River Basin due to the absence of brook trout and presence of good habitat conditions. Habitat improvement projects in the Upper Mainstem John Day River should result in increased bull trout distribution. Population trends have not been documented in the Upper Mainstem John Day River.

Call and Reynolds Creeks have been used for index redd counts. The redd counts in Call Creek have ranged from 2 to 15 redds during annual redd surveys although surveyors have reported seeing an abundance of bull trout when conducting field work. Restoration work conducted in Reynolds Creek has re-established fish passage so Reynolds Creek may be a good indicator of redd trends in future years.

Umatilla River Core Area

The Umatilla River basin headwaters drain from the coniferous forested, western slopes of the Blue Mountains in northeastern Oregon through steep volcanic canyons, rolling foothills, and broad alluvial lowlands before eventually reaching the Columbia River at about river km 470 (river mile 292) below McNary Dam (USFWS 2002). Major tributaries of the Umatilla River include the North and South forks, Meacham Creek, Birch Creek, Butter Creek, and Wildhorse Creek. Of these, the north and south forks and Meacham Creek contain the most current and potential bull trout spawning and rearing habitat for bull trout (USFWS 2002). The recovery plan identified one local population, the upper Umatilla Complex that includes the North Fork and South Fork Umatilla Rivers, although spawning has only been documented in the North Fork Umatilla River.

Both resident and fluvial bull trout are known to occur in the Umatilla River watershed. Redd counts have been done each year since 1998 on the North Fork Umatilla River, and periodically in the South Fork Umatilla River and North Fork Meacham Creek. In 2003 and 2004, the North Fork Umatilla River appeared to support the core area's entire bull trout spawning population, with no redds detected in the South Fork Umatilla or in North Fork Meacham Creek. Redd totals on the North Fork Umatilla River have fluctuated considerably, and have averaged about 50 redds since 1998; however, the last 5-year average (2009 to 2013) was only 19 redds, suggesting this population is declining (USFWS unpublished data 2015).

Along the Umatilla River downstream from Pendleton, irrigated agriculture dominates, and there are six major irrigation dams and diversions (Anglin *et al*. 2008). Historically, sections of the lower river were often dewatered during the irrigation season (March to October). Congress enacted the Umatilla River Project Act in 1988 to ensure adequate flows were provided for migrating salmon and steelhead. Despite the enactment of the Umatilla River Project Act in 1988 to ensure adequate flows were provided for migrating salmon and steelhead, sections of the mainstem Umatilla River have inadequate streamflows to provide fish passage (typically from mid-July to late August) (Anglin *et al*. 2008). Water temperature data from the South Fork Umatilla River and its tributaries indicate that suitable habitat for bull trout is very limited in this drainage (USFS 2001, Contor 2004). The 16-km (10-mile) section of the mainstem Umatilla River downstream from the mouth of McKay Creek (river km 82.0 [mile 51]) is the only section of the lower river thought to have summer temperatures suitable for salmonids (Contor 2004). This section of the stream is kept artificially cool by hypolimnetic (deep, colder) water releases from McKay Reservoir. The greatest threats within the Umatilla core area include water quality impairment from multiple sources (*e.g.*, agricultural practices, urban development, etc.), dewatering/low flows, agricultural practices (irrigation diversions, water quality effects), passage barriers to migration, and development (*e.g.*, urbanization and transportation networks) (USFWS 2008).

Walla Walla River Core Area

The Walla Walla River (WWR) basin headwaters drain from the coniferous forested, western slopes of the Blue Mountains in northeastern Oregon/southeastern Washington through steep volcanic canyons, rolling foothills, and broad alluvial lowlands before eventually reaching its confluence with the Columbia River at about river km 509 (river mile 316) (Schaller *et al.* 2014). Major tributaries of the WWR are Touchet River (also a separate core area immediately to the north), Mill Creek, and the South Fork of the Walla Walla River (South Fork). The North Fork Walla Walla River (North Fork) and Yellowhawk Creek are smaller tributaries within this core area. The WWR core area contains three local populations in the upper Mill Creek, Low Creek, and the South Fork Walla Walla River.

Walla Walla Basin bull trout exhibit a true continuum of life histories involving movements, migrations, spawning, rearing, and foraging over different temporal and spatial scales (Schaller *et al.* 2014). Commonly, multiple life stages concurrently occupy a given stream reach, utilizing its attributes for different purposes. Recent genetic data indicate there is greater genetic differentiation between Low Creek and the other Walla Walla populations (Mill Creek and South Fork Walla Walla) than there is between Mill Creek and South Fork Walla Walla and even between the Walla Walla populations versus the Touchet or Tucannon, which are identified as different core areas (Howell et al., in prep.) This is also supported by differences in life histories (resident vs. migratory), size, demography/population trends, and habitat characteristics. This markedly differs from results comparing resident versus migratory fish in the South Fork Walla Walla (Homel et al. 2008).

The South Fork Walla Walla and Mill Creek support sizeable bull trout populations (USFWS 2008), however redd counts in both populations have been declining since 2001 (USFS unpublished data). In the South Fork Walla Walla redd counts peaked in 2001 at over 400 and have steadily declined to just above 100 in 2012. Although the total number of bull trout, including juveniles, appears to be stable, the number of large adults is declining (Schaller et al 2014) as are total adults, as reflected in the redd counts. Likewise, adult abundance in Mill

Creek declined 63 percent during 2006 to2010 with even greater declines in subadult survival (Howell & Sankovich 2012, Howell et al. in review).

The quality of habitat for most bull trout life stages, strategies and actions is generally better in headwater reaches and degrades incrementally downstream from the Umatilla National Forest boundary as the severity and often cumulative anthropogenic modifications and other influences become more prevalent (Schaller *et al.* 2014). While the resident component of the population only experiences headwater conditions, migratory bull trout may be exposed to a spectrum of anthropogenic channel modifications, riparian habitat degradation, varying levels of streamflow depletion and regulations, and other influences throughout the basin and in the mainstem Columbia River. In the middle and lower WWR, as flows decrease and are largely diverted for agricultural purposes and water temperatures elevate, habitat conditions become progressively less favorable for most bull trout uses. The greatest threats within the WWR core areas include dewatering/low flows that result in significant barriers; water quality impairment from multiple sources (*e.g.*, agricultural practices, urban development), and passage barriers to migration (USFWS 2008). Improving habitat conditions to restore connectivity (including removing low flow barriers) among local populations is critical to maintaining redundancy and supporting resiliency of bull trout in the WWR core area (Schaller *et al.* 2014).

Touchet River Core Area

As a tributary to the Walla Walla River, the Touchet River core area is part of the Lower Mid-Columbia Geographic Area in southeast Washington. The Touchet River drains the northern and northwestern portions of the Walla Walla Basin before entering the lower mainstem Walla Walla River about 21.6 miles (34.8 km) upstream of the Columbia River near the community of Touchet, Washington. The North Fork, South Fork and Wolf Fork feed into the Touchet River at the base of the Blue Mountains near the City of Dayton. Lewis Creek and Spangler Creek are main tributaries to the North Fork Touchet River, while the Burnt Fork is the main tributary to the South Fork Touchet River.

Historically bull trout were thought to be widely distributed in the Touchet River watershed (Mendel *et al*. 2003). Currently, local populations in the Touchet River core area occur in the North Fork, Wolf Fork, and in the Burnt Fork of the South Fork Touchet River (Kassler and Mendel 2007; Mendel *et al*. 2014). Both fluvial migratory and resident forms are present throughout. However, recent telemetry and PIT tag data indicate migratory bull trout in the Touchet River core area remain within the overall Walla Walla basin, foraging and overwintering in the lower Touchet drainage or mainstem Walla Walla River, and do not migrate further downstream into the Columbia River (Schaller *et al*. 2014). Kassler and Mendel (2007) determined that more than 50 percent of migratory bull trout in the Touchet River core area originate from the Wolf Fork population. Spawning also occurs in Spangler and Lewis Creeks; however, genetics from individuals from each tributary were not distinguishable from either North Fork or Wolf Fork individuals (Kassler and Mendel 2007). Redd counts in the North Fork and Wolf Fork between 1999 and 2013 suggest that these two local populations are stable (Mendel *et al*. 2014). However, redd count data for the Burnt Fork of the South Fork Touchet is more limited. Bull trout redds were first observed in 2000, but not detected in 2003 and 2004 (Mendel *et al*. 2004; Mendel *et al*. 2007; Mahoney *et al*. 2009; Fitzgerald pers. comm. 2015). Since 2005, access to complete surveys in the Burnt Fork has been restricted across private property (Mendel *et al*. 2014; A. Fitzgerald, pers. comm. 2015).

Elevated water temperatures from factors such as damaged riparian vegetation, increased sedimentation, and decreased water flows have reduced habitat quality for bull trout in the Touchet drainage (Mendel *et al*. 2003). Introduced brown trout and rainbow trout likely compete with native bull trout for food and habitat, while introduced non-native walleye and small mouth bass in the lower reaches of the Touchet and mainstem Walla Walla River pose a predatory risk to juveniles and sub-adults in the basin. There are a few partial or seasonal barriers to movement in the core area that limit connectivity between local populations. Flood control levees have confined the river and reduced channel complexity and wood recruitment. Recent climate change modeling indicates that the Touchet drainage is at high risk for reduced instream flows, elevated water temperatures, and reduced habitat suitability into the future and existing habitat threats will likely be exacerbated (Schaller *et al*. 2014).

Upper Mid-Columbia Geographic Region

Salmo River Core Area

The Salmo River basin is a transboundary system flowing from the Selkirk Mountains of British Columbia (B.C.) and northern Idaho and Washington in the United States. The Salmo River drains into the Pend Oreille River approximately 3 miles (5 km) downstream of the international border. Major tributaries of the Salmo River include Apex, Clearwater, Hall, Barrett, Ymir, Porcupine, Hidden, Boulder Mill, Erie, and Sheep Creeks, and the South Fork of the Salmo River (South Fork). Out of all the major Salmo River tributaries, only the South Fork originates in the United States. The headwaters of the South Fork originate in northern Idaho, with the entire United States portion located within the Salmo Priest Wilderness Area. Several small tributaries drain into the South Fork, including Watch and Lead Creeks. The core area contains four local populations in the upper Salmo mainstem: Clearwater Creek, Sheep Creek, Stagleap Creek, and the South Fork (Green *et al.* 2006).

Bull trout in the Salmo River watershed exhibit primarily a fluvial migratory life history with FMO habitat occurring from approximately river km 44 (river mile 27) to the confluence with Pend Oreille River (Green *et al.* 2006). In Canada, the Salmo River is identified as one of the most threatened populations in British Columbia, with an estimated number of redds per year between 38 and 109 (1998 to 2009) and an estimated population size between fewer than 50 to as many as 250 adults (Hagen and Decker 2011). Thirty-six adult bull trout were observed between 1974 and 2014 in the South Fork of Salmo River within Washington (Andonaegui 2003; Kalispel unpublished data). Recent fish surveys conducted by Kalispel Tribe of Indians and Seattle City Light in the South Fork and its tributaries in August 2014 yielded 51 subadult and 9 adult in the main stem and 1 subadult bull trout in Watch Creek. While exhaustive surveys of the South Fork have not been completed, recent data suggests that the United States portion of the watershed is significant to the overall persistence of the core area. Field surveys in 2006 by the USFS did not observe any bull trout in Lead Creek (USFS 2009). Several natural barriers in the South Fork may represent barriers to bull trout upstream of Watch Creek (Connor *in litt.* 2015).

The United States portion of the South Fork is located within the Salmo Priest Wilderness Area with streams and riparian areas supporting adequate shade, detritus, and large instream wood that are likely to provide abundant food base and cover (USFS 1999 as referenced in Andonaegui 2003). Hagen and Decker (2011) determined that habitat in Canadian waters for bull trout is marginal due to: 1) high water temperatures, 2) lack of fish prey base, 3) high risk of hybridization due to abundant brook trout populations, and 4) reservoir conditions that favor non-native fish. Recently, partners in British Columbia and the United States have begun developing a Salmo Watershed Aquatic Ecosystem Health Action Plan (Nellestijn *in litt* 2015). The draft action plan further identified habitat degradation, illegal harvest, high water temperatures, nonnative species, and loss of in-basin connectivity as threats to the persistence of Salmo River populations. Historically, some gene flow between Salmo River and other core areas in the Columbia and Pend Oreille Rivers is probable (Dunham *et al.* 2014). However, the evidence suggests that bull trout from upstream likely provided genetic material to the Salmo River but life history and natural barriers limited upstream genetic movement (USFWS 2010; Dunham *et al.* 2014). Due to reduced population numbers and existing threats within the Salmo River, Dunham *et al.* (2014) concluded that managing passage over Boundary Dam may pose significant risks to Salmo River populations.

Methow River Core Area

The Methow River core area is located in Okanogan County and drains an area of approximately 4,895 square km (1,890 square miles) (NPPC 2001b). The watershed drains in a northwest to southeast direction and over 60 percent of the annual precipitation within the Methow River basin occurs between October and March (NPPC 2001b; Parametrix, Inc. 2000). The confluence of the mouth of the Methow River with the Columbia River is at river km 843 (river mile 524) near Pateros in north central Washington. The valley spans 4,726 square km (1,825 square miles) in the northwestern segment of Okanogan County. Precipitation is primarily in the form of snow with summer thunderstorms contributing minor amounts. The upper reaches of the basin along the Cascade Crest receive as much as 203.2 centimeters (80 inches) of precipitation annually. The amount of precipitation drops with elevation, with only about 25.4 centimeters (10 inches) occurring in the lower elevations each year. Average monthly flows within the lower Methow River range from 12 cubic meters per second (424 cubic feet per second) in January and February, to 170 cubic meters per second (5,963 cubic feet per second) in June (Parametrix, Inc. 2000). Major tributaries used by bull trout include Gold Creek, Beaver Creek in the lower basin; the Twisp River, Wolf Creek in the middle basin; and Chewuch, Lost, and West Fork Methow Rivers, Lake, Goat, and Early Winters Creeks in the upper basin.

Most of the land in the lower watershed has been heavily modified by a combination of farming, irrigation diversion, or residential and recreational development (WSCC 2000). Upslope of the private lands are National Forest lands, and a majority of these are used for timber management. There is also a small section of the Pasayten Wilderness located in the northern portion of the watershed. Fire is an important natural disturbance in the Methow basin (USFS 1996). High-intensity, stand replacing fires is a dominant process in the upper elevations. In the lower elevations, the historic fire regime is characterized with a recurrence interval of 5 to 10 years. Temperatures in the Methow River remain cold in the upper reaches but are near upper tolerance levels in lower reaches for salmonids and climate change will further increase temperatures impacting how migratory bull trout habitat is used. Connectivity to cool water and food sources will be important to maintain. The Methow is unique in that it is one of the basins that is predicted to maintain glaciers as sources of cold water through the period of climate change.

Both legacy and ongoing threats continue to impact bull trout populations in the core area. Management actions such as fire suppression and selective timber harvesting have changed much of the area to an unnatural high-intensity fire regime. With increased fire burned areas, summer high-intensity rainstorms and rain on snow events can cause accelerated rates of erosion. Forest management on both National Forest and private timber lands, agriculture operations, fish management at the Winthrop National Fish Hatchery (WNFH), and numerous irrigation diversions have both legacy and current ongoing impacts. Populations are also impacted by management outside of the basin from ongoing operation of dams operated for Federal and local power generation (*i.e.*, Grant, Chelan, and Douglas County PUD, Chief Joseph and Grand Coulee dams).

The basin lies within areas of usual and accustomed areas for the Yakama Nation and Colville Confederated Tribes. The Winthrop National Fish Hatchery (WNFH) is one of three mid-Columbia stations constructed by the BOR and managed as fish mitigation facilities for the Grand Coulee Dam, Columbia Basin Project. WNFH was constructed by the Bureau of Reclamation between 1940 and 1942. Fish cultural operations were initiated at Winthrop in 1942 and have been operated since by the Service as one of the fish mitigation facilities for Grand Coulee Dam, Columbia Basin Project.

The distribution of bull trout occurs throughout the Methow Basin. In the original draft recovery plan we identified 9 local populations; in 2010 the Service identified 10 local populations with the addition of Lake Creek and information from recent genetic analyses (DeHaan and Neibauer 2012). The Methow core area exhibits multiple life history patterns and bull trout spawn in the general window of mid-September to mid-October, and similar to the Yakima core area, the Methow core area has populations that spawn in late August into early November. Local populations consisting of adfluvial migratory adults migrate to Black Lake from the Chewuch and Methow and from Cougar, First Hidden, and Middle Hidden Lakes to the Lost River and adjacent tributaries. Fluvial forms exist that migrates from the mainstem Methow, Wenatchee, Okanogan, or Columbia Rivers to spawning areas near the crest of the Cascade Mountains. A small percentage (15 to 20 percent) is estimated to migrate long distances including into other core areas for forage, migration, or overwintering and may migrate back to spawning areas annually, semi-annually, or every few years (USFWS 2006, Nelson and Nelle 2008, Kelly Ringel *et al*. 2014, BioAnalysts 2004, PTAGIS 2015, Stevenson et al 2009). There are some resident life history forms that comingle with the migratory forms in several core areas (J. Neibauer and M. Nelson, pers. comm. 2015) and that exist upstream of barrier falls (*i.e.*, Early Winters Creek).

The Beaver Creek population is functionally extirpated and has not been observed in recent surveys (J. Crandall, pers. comm. 2015). Several populations are decreasing or stable at low abundances (*i.e.*, less than 20 migratory redds or approximately 40 individuals) including: Gold, Lake, Wolf, and Goat Creeks. The Lost River population is unknown but suspected to be at moderate abundance (*i.e.*, more than 20 redds but less than 50 redds) though information is lacking to adequately assess it. The Lost River is the only population open to harvest and it is unknown how life history forms function or what current population levels are. Several local populations are stable at moderate to high (*i.e.*, over 50 migratory redds or approximately 100 spawning adults) abundances (*i.e.*, West Fork Methow and Twisp Rivers). The Chewuch and Lost River both exhibit lacustrine-fluvial and lacustrine-adfluvial forms as similarly described by Northcote (1997) and Brenkman *et al.* (2001), which migrate both upstream and downstream of rivers and lakes to spawn. Climate change may have added impacts to forage, migration, and overwintering habitat and connectivity will be key for recovery. However, it is predicted that the Methow basin will maintain cold water conditions in headwater spawning areas during climate changes.

Entiat River Core Area

The Entiat River is located in Chelan County and drains an area of approximately 1,085 square km (419 square miles) (NPPC 2001c; WSCC 1999). The headwaters of the Entiat River are in glaciated basins near the Cascade Crest. Flowing southeasterly the Entiat River enters the Columbia River near the town of Entiat, approximately 32 km (20 miles) upstream from Wenatchee. Precipitation ranges from about 25.4 centimeters (10 inches) at the mouth of the Columbia River to 228 centimeters (90 inches) in the headwaters (WSCC 1999). Summer thunderstorms can produce flash floods in narrow tributary channels. The steep topography, pinnate drainage pattern, relatively low drainage density and short drainage length is conducive to rapid mainstem flow response time and can result in a “flashy” flow regime. Mean annual peak flow is approximately 99 cubic meters per second (3,500 cubic feet per second) and mean annual base flow is around 2.3 cubic meters per second (80 cubic feet per second).

Approximately 90,720 ha (224,000 acres) of the 108,540-ha (268,000-acre) drainage area are in public ownership, primarily U.S. Forest Service lands, with lesser amounts of land administered by the Bureau of Land Management and Washington Department of Fish and Wildlife (USFS 1996). Agriculture is an important land use in the lower portion of the valley that includes 527 ha (1,300 acres) of orchards. Bull trout reside in the two major tributaries, the North Fork Entiat River and the Mad River. Bull trout habitat is limited in this core area due to the naturally small sized of the watershed and the location Entiat Falls.

The Entiat River watershed can be divided into three broad geomorphic settings, the Transportation, Transition, and Deposition Zones (USFS 1996). The Transportation Zone extends from the headwaters of the Entiat River down to Entiat Falls, and lies within the Wenatchee Highlands Subsection (USFS 1996). It consists of strongly-glaciated land types, and has high subsurface water storage capacity. Woody debris and sediment are recruited from stream banks and a naturally high occurrence of debris flows. The Transition Zone extends from Entiat Falls downstream to near the National Forest boundary. The Transition Zone is an area of glacially-influenced mountain slopes without the strong expression of glacial troughs (USFS 1996). The primary bull trout spawning and rearing in the Mad and Entiat Rivers occurs in the Transition Zone. The lower Entiat is in the Deposition Zone where sediment deposition is the dominant process and warmer waters limit spawning and rearing.

Fire is an important natural disturbance in the Entiat basin (USFS 1996). High-intensity, stand replacing fires with 50 to 100 year recurrence intervals are a dominant process in the upper elevations. In the lower elevations, the historic fire regime is characterized by low-intensity fires with a recurrence interval of 5 to 10 years. Temperatures in the lower Entiat River are near upper tolerance levels for salmonids and climate change will further increase temperatures impacting how migratory bull trout habitat is used. Connectivity to cool water and food sources will be important to maintain.

Both legacy and ongoing threats continue to impact bull trout populations in the core area. Management actions such as fire suppression and selective timber harvesting have changed much of the area to an unnatural high-intensity fire regime. With increased fire burned areas, summer high-intensity rainstorms and rain on snow events can cause accelerated rates of erosion. Forest management on both National Forest and private timber lands, agriculture operations, fish management at the Entiat National Fish Hatchery, and irrigation diversions have both legacy and current ongoing impacts. Populations are also heavily impacted by management outside of the basin from ongoing operation of dams operated for Federal and local power generation (*i.e.*, Grant, Chelan, and Douglas County PUD, Chief Joseph and Grand Coulee dams). This core area is unique in that over 90 percent of the bull trout that use the core area for spawning and rearing, use the mainstem Columbia River for forage, overwintering, and migration. The basin lies within areas of usual and accustom areas for the Yakama Nation and Colville Confederated Tribes. The Entiat National Fish Hatchery is one of three mid-Columbia stations constructed by the BOR and managed as fish mitigation facilities for the Grand Coulee Dam, Columbia Basin Project. ENFH was constructed on 15 ha (37 acres) of land by the Bureau of Reclamation and has been operated since 1941 by the Service as one of the fish mitigation facilities for Grand Coulee Dam, Columbia Basin Project.

The distribution of bull trout occurs in only a portion of the Entiat Basin. Entiat Falls is a natural barrier to upstream migration for bull trout and due to its small size the core area is naturally limited. In the original 2002 Draft Recovery Plan we identified two local populations; in 2010 we also identified two local populations with recent genetic analyses (DeHaan and Neibauer 2012). The bull trout from the Entiat core area generally exhibit a fluvial life history pattern. Populations spawn in the general window of mid-September to mid-October. Local populations generally migrate from spawning areas to the Columbia River, with some migrating longer distances to the Wenatchee, Methow, and Yakima core areas presumably for foraging and overwintering (Nelson and Nelle 2008, PTAGIS 2015, BioAnalysts 2004 Stevenson et al 2009). There are some resident life history forms that comingle with the migratory forms in the Mad River (J. Neibauer and M. Nelson, pers. comm. 2015). Both populations are declining in abundances (*i.e.*, less than 20 migratory redds or approximately 40 individuals). Bull trout from this core area depend heavily on the larger Columbia River for overwintering habitat and as such, threats can have high impacts on these two populations. Climate change may have added impacts to forage, migration, and overwintering habitat and connectivity will be key for recovery.

Wenatchee River Core Area

The Wenatchee basin is located in Chelan County and encompasses approximately 3,551 square km (1,371 square miles) in central Washington (NPPC 2001d; USFS 1999a; 1999b; WSCC 2001). The watershed heads at the Cascade crest and flows east towards the Columbia Plateau (Figure 3). The Wenatchee River drains into the Columbia River at the town of Wenatchee. Bull Trout occur in most major tributaries and are in the White and Little Wenatchee Rivers, which drain into Lake Wenatchee (source of the Wenatchee River), the Chiwawa River and Nason Creek which are considered the upper Wenatchee basin, in Chiwaukim Creek within the middle basin, and in Icicle Creek, Peshastin Creek, and Mission Creek, which are generally within the lower portions of the basin.

Higher elevations receive heavy precipitation with accumulations close to 385 centimeters (150 inches) annually and Lower portions of the basin receive less than 22 centimeters (8.5 inches) of precipitation annually (WSCC 2001). Average monthly discharge in the basin varies from a low of 24 cubic meters per second (836 cubic feet per second) in September to 258 cubic meters per second (9,043 cubic feet per second) in June (Parametrix, Inc. 2000).

As described by the U.S. Forest Service, two major subsections, the Wenatchee Highlands and Swauk Sandstone Hills, dominate the basin geology (USFS 1999a). There is well-regulated summer flows with relatively low summer stream temperatures, especially in tributaries while stream temperatures during low summer flows in the mainstem rivers can approach the upper lethal limits for salmonids. Temperatures are predicted to increase with climate change (Isaak *et al.* 2015) and connectivity between larger rivers, lakes, and the mainstem Columba River will be important to the movement patterns of Wenatchee core area bull trout populations.

The lower to mid-basin Swauk sandstone land forms lie within the rain shadow of the crest of the Cascade Mountains, and with the exception of some headwaters areas, are relatively dry landscapes. Historically, much of the lower Wenatchee Swauk Sandstone Hills experienced a natural high frequency of low-intensity fires (USFS 1999a). Both legacy and ongoing threats continue to impact bull trout populations in the core area. Management actions such as fire suppression and selective timber harvesting have changed much of the area to an unnatural high-intensity fire regime. With increased fire burned areas, summer high-intensity rainstorms and rain on snow events can cause accelerated rates of erosion. Forest management on both national Forest and private timber lands, agriculture operations, fish management at the Leavenworth National Fish Hatchery, dams managed for irrigation (*i.e.*, Dryden Dam and Peshastin and Icicle Diversions) and for fish management (*i.e.*, Tumwater Dam and Chiwawa weir) have both legacy and current ongoing impacts. Populations are also impacted by management outside of the basin from ongoing operation of dams operated for Federal and local power generation (*i.e.*, Grant, Chelan, and Douglas County PUD, Chief Joseph and Grand Coulee dams).

The basin lies within areas of usual and accustomed areas for the Yakama Nation and Colville Confederated Tribes. The Leavenworth National Fish Hatchery (LNFH) is located in the basin and is one of three mid-Columbia stations constructed by the BOR and managed as fish mitigation facilities for the Grand Coulee Dam, Columbia Basin Project. Construction of the LNFH took place from 1938 to 1940 on 69 ha (170 acres) of Icicle Valley land, 3 km (2 miles) south of the town of Leavenworth, and had fully or partially blocked fish passage until recently.

The distribution of bull trout occurs throughout the Wenatchee Basin. In the original draft recovery plan we identified six local populations; in 2010 the Service identified seven local populations with the addition of Icicle Creek and recent genetic analyses (DeHaan and Neibauer 2012). The Wenatchee River core area exhibits multiple life history patterns and is one of the most diverse populations with some of the best habitat in the geographic area. Most populations spawn in the general window of mid-September to mid-October. Local populations consist of a migratory form that migrates to Lake Wenatchee, the mainstem Wenatchee, or Columbia Rivers to spawning areas near the crest of the Cascade Mountains. A small percentage (15 to 20 percent) is estimated to migrate long distances, including into other core areas, for foraging, migration, or overwintering and may migrate back to spawning areas annually, semi-annually, or every few years (USFWS 2006, Kelly Ringel *et al*. 2014, BioAnalysts 2004, Nelson and Nelle 2008, PTAGIS 2015, Stevenson et al 2009). There are some resident life history forms that comingle with the migratory forms in several core areas (J. Neibauer and M. Nelson, pers. comm. 2015) and that exist upstream of barrier falls (*i.e.*, Little Wenatchee River). Two populations are declining in abundances (*i.e.*, less than 10 migratory redds or approximately 20 individuals); 3 are in unstable or moderate abundances (*i.e.*, Peshastin, Chiwaukum, Icicle

Creeks); and 2 are in relatively stronger abundances (*i.e.*, White and Chiwawa), of which the Chiwawa is the only long term stable population. The Chiwawa is the only population in the Wenatchee River core area and within the geographic area that can exhibit all life history stages and remains stable with greater than 100 migratory redds or greater than about 200 adults. The Chiwawa also exhibits both lacustrine-fluvial and lacustrine adfluvial forms as similarly described by Northcote (1997) and Brenkman *et al.* (2001), which migrate both upstream and downstream of rivers and lakes to spawn. Climate change may have added impacts to forage, migration, and overwintering habitat and connectivity will be key for recovery.

Yakima River Core Area

The Yakima River basin is located in south central Washington, draining approximately 15,900 square km (6,155 square miles) into the Columbia River (WDFW 1999; NPPC 2001e). The basin occupies most of Yakima and Kittitas counties, about half of Benton County and a small portion of Klickitat County. It is bounded on the west by the Cascade Range, on the north by the Wenatchee Mountains, on the east by the Rattlesnake Hills, and on the south by the Horse Heaven Hills. The Yakima River flows southeasterly for about 344 km (214 miles) from its headwaters in the Cascade Mountains at Keechelus Dam to its confluence with the Columbia River (NPPC 2001e). Altitudes in the basin range from 2,496 meters (8,184 feet) above mean sea level in the Cascades to 104 meters (340 feet) at the confluence where it enters the Columbia River at river km 536 (river mile 333) near the city of Richland, Washington. The Naches River is the largest tributary of the Yakima River, flowing 72 km (45 miles) to its confluence at the City of Yakima. The Naches River forms at the confluence of the Bumping, American, and the Little Naches Rivers and harbors a large portion of the local populations in the Yakima core area. The Yakima Basin above the Naches River, generally referred to as the Upper Yakima basin, contains the smaller number of bull trout local populations.

The climate of the Yakima River basin ranges from alpine along the crest of the Cascade Range to arid in the lower valleys (NPPC 2001e). Precipitation varies considerably across the basin throughout the year. Mean-annual accumulations range from about 325 centimeters (128 inches) in the higher elevations of the mountains to less than 20 centimeters (8 inches) in the far eastern half of the basin (System Operations Advisory Committee (SOAC) 1999). If climate change predictions for the Northwest are realized, these patterns may shift over time, and are predicted to impact bull trout populations.

The Yakima River basin is a rich agricultural area almost totally dependent on irrigation. It contains about 200,000 ha (500,000 acres) of irrigated land with the water for most of this acreage supplied by the Yakima Irrigation Project of the U.S Bureau of Reclamation (BOR). Other major land uses include livestock production (ranching, feedlots, and dairies), timber production, and recreation. There are five major storage reservoirs in the Yakima River basin. Keechelus, Kachess, and Cle Elum reservoirs are located high in the upper Yakima basin. The dams forming these reservoirs were completed in 1917, 1912 and 1933, respectively. In the Naches River subbasin, Bumping Dam was constructed in 1910 forming Bumping Reservoir, while Tieton Dam, forming Rimrock Reservoir, was completed in 1925. All of these dams except for Tieton were built at the outlets of natural lakes. Fish passage facilities were not constructed and bull trout and other resident trout are isolated both above and below these dams. Native sockeye salmon, which depend on the natural lakes and spawn in the streams above them, were extirpated; other anadromous salmonid species were excluded from the streams above these dams. Non-native fish have been introduced both above and below these dams. Additionally, several other dams may have limited passage, while diversions and screening of facilities continues to be an impact (Clear and Easton Lakes, diversions, etc.).

These large reservoirs have a total storage capacity of about 1 million acre-feet (SOAC 1999). In addition, there are numerous irrigation diversions with associated fish screens, traps, and canals. These features have severely altered the natural hydrographs of the rivers in the Yakima River basin. These altered hydrographs are now characterized by much lower than normal winter flows, as water is stored for the next years' use, and much higher than normal summer flows, as water is delivered in-channel to various diversion points for irrigation. During the run-off period in the spring, high flows still occur during most years but the magnitude of these flows is greatly reduced relative to what would have occurred naturally. During the winter and early spring, higher flows may also occur when water is released from the reservoirs during flood control operations. The annual estimated unregulated runoff of the Yakima River at the Parker Gauging Station (in the lower river) averages 3.5 million acre-feet (SOAC 1999). The average annual irrigation diversion requirements are approximately 2.2 million acre- feet. Approximately 375,000 acre-feet returns as irrigation return flow in a normal water year (BOR 1999).

The entire basin lies within reservation lands or other usual and accustom areas for the Confederated Tribes of the Yakama Nation. In addition, a large portion of the headwaters are National Forest and private forest lands and lands, reservoirs, and water used for irrigation by the Bureau of Reclamation, and WDFW lands reserved for wildlife. In the lower Yakima the US Army operates the Yakima Training Center as part of the Joint Base Lewis-McChord (http://www.lewis-mcchord.army.mil/yakima), and the Department of Energy manages one of the largest nuclear cleanup sites at the Hanford site (http://www.hanford.gov), and the Service manages the Hanford National Monument (http://www.fws.gov/refuge/Hanford_Reach).

The distribution of bull trout occurs throughout the Yakima Basin. Since the time of listing, several populations are declining and/or have become functionally extirpated. In the original 2002 Draft Recovery Plan we identified 13 local populations, in 2010 we identified 16 local populations and since then we recognize that there are 15 local populations as a result of recent genetic analyses and current information in the Yakima Action Plan (Small *et al*. 2009, Reiss *et al*. 2012, Small and Martinez 2013). The Yakima core area exhibits multiple life history patterns but is heavily impacted by fish passage barriers at mainstem river dams (*i.e.*, BOR dams) and populations are currently mostly adfluvial or resident forms. Fluvial forms, located below mainstem Naches and Yakima BOR dams consist of fish from both unique local populations and from population located above the dams that are "flushed" downstream (Mizell and Anderson, 2010, Small *et al*. 2009, and Small and Martinez 2013). Most populations spawn in the general window of mid-September to mid-October but several are unique and spawn between August and early September and late October to early November, exhibiting some of the longest timeframes in the Upper Columbia Geographic Area.

Stream flow and temperature, and passage conditions between the larger rivers and tributaries, both within and downstream of reservoirs, have changed from historic conditions due to the operations of the BOR's Yakima Basin Irrigation Project and may have caused migration windows to change through time. In addition, climate change may have added effects to spawning migrations. Bull trout populations are distributed across the core area but are currently impacted by the current habitat condition in migration corridors and lack of fish passage at mainstem dams and diversions operated by the BOR and other irrigation districts diversions and dams. The current status of the populations in the core area is similar to that in the previous 2002 Draft Recovery Plan but the migratory populations seem to be declining (*i.e.*, Indian Creek). Three populations are functionally extirpated (*i.e.*, Teanaway, Cle Elum, and Waptus) although a redd or bull trout have been observed occasionally. Seven of the local populations (*i.e.*, Ahtanum, Crow, N Fork Tieton, Box Canyon, Kachess, Gold, and Upper Yakima River) have extremely low abundances (*i.e.*, less than 20 redds). Two (*i.e.*, Rattlesnake Creek and American River) exhibit moderate abundances (*i.e.*, 20 to 50 redds). One population that used to be stable with more than 100 redds is on a rapid decline, likely due to variables within the Rimrock Reservoir and several landslides impacting spawning in the last 2 years. Two populations exhibit higher abundances with redds ranging from 137 to 207 on average (*i.e.*, Deep

Creek and S. Fork Tieton) and seem to remain fairly stable, though migration to other areas in the core area is blocked by Tieton Dam and to some degree Clear Lake Dam.

Lower Snake Geographic Region

Clearwater River Basin Introduction

The Clearwater River Basin is located east of Lewiston, Idaho, and extends from the Snake River confluence at Lewiston on the west to headwaters in the Bitterroot Mountains along the Idaho and Montana border on the east in Nez Perce, Latah, Lewis, Clearwater, Idaho, and Shoshone counties. The Clearwater River basin includes four Core Areas: South Fork Clearwater River, North Fork Clearwater River, Lochsa River, and the Selway River. As discussed earlier, several changes have been made to the Clearwater River core areas since the 2002 Draft Bull Trout Recovery Plan. Within the North Fork Clearwater River drainage, the Fish Lake core area was absorbed into the surrounding North Fork Clearwater River core area. Similarly, the Fish Lake core area within the Lochsa River drainage is now included in the surrounding Lochsa River core area. It was determined that these two Fish Lake populations are not isolated from the surrounding two core areas and represent a continuation of the headwater populations in both the Lochsa River and North Fork Clearwater River core areas. Additionally, because local populations of bull trout have not been confirmed within tributaries to the previously identified Lower-Middle Clearwater River core area, it is no longer considered a core area. However, the mainstem Clearwater River and Middle Fork Clearwater River (Clearwater River shared FMO) still provide essential FMO habitat and connectivity between core areas. Both adult and subadult bull trout utilize the Clearwater and Middle Fork Clearwater Rivers and various tributaries primarily as foraging, migratory, rearing, and overwintering habitat.

The Clearwater River shared FMO area includes the Middle Fork and mainstem Clearwater Rivers and encompasses approximately 664,000 ha (1,640,500 acres). The Middle Fork Clearwater River is formed by the confluence of the Selway and Lochsa Rivers near Lowell, Idaho. It flows in a westerly direction for 37 km (23 miles) until it converges with the South Fork Clearwater River near Kooskia, Idaho. At this point the river is locally known as the mainstem or lower Clearwater River (CSS 2001) and continues westerly and northwesterly to the town of Ahsahka, where it is joined by the North Fork Clearwater River. The Clearwater River then converges with the Snake River at Lewiston, Idaho, 120 km (75 miles) from its source (BLM 2000). The lower Clearwater River is located in Nez Perce, Latah, Lewis, and Clearwater counties.

Bull trout are distributed throughout most of the large rivers and associated tributary systems within the Clearwater River core areas (USFWS 2002) and exhibit adfluvial, fluvial, and resident life history patterns. Fluvial and resident bull trout are the predominant life history forms known to occur within each core area. There are also two naturally occurring adfluvial bull trout populations within the Clearwater River basin; one is associated with Fish Lake in the North Fork Clearwater River drainage, and the other is associated with Fish Lake in the Lochsa River drainage (USFWS 2002d).

South Fork Clearwater River Core Area

The South Fork Clearwater River core area is located in Idaho County and encompasses an area of approximately 304,522 ha (752,474 acres). The core area extends from the confluence with the Middle Fork Clearwater River at Kooskia, Idaho, to the headwaters above Elk City and Red River. Major tributaries within the core area include: American, Red, and Crooked Rivers, Mill, Newsome, Johns, Tenmile, Meadow, Leggett, Cougar-Peasley, Silver, Wing, and Twentymile Creeks. The core area includes a mixture of private and public lands.

Bull trout are widely distributed throughout the South Fork Clearwater River (USFS 2014). However, trend data for the South Fork Clearwater River core area indicate that bull trout are declining (Meyer *et al*. 2014). Total abundance for local populations in most of this core area is unknown at this time. For the most recent bull trout 5-year status review (USFWS 2008b), the Service concluded that the core area is at risk of extirpation as the threats are substantial and imminent. Fluvial and resident bull trout are the predominant life history forms known to occur within this core area. Bull trout are currently known to use SR habitat in five stream complexes within the South Fork Clearwater (*i.e.*, local populations). These local populations include Red River Complex, Crooked River Complex, Newsome Creek Complex, Tenmile Creek Complex, and Johns Creek Complex. Although research is limited on certain tributaries such as Crooked River, many are considered to have very high habitat potential for bull trout (USFS 1998; CBBTTAT 1998a). The upper Crooked River (East Fork and West Forks Crooked Rivers) is considered a habitat stronghold for bull trout spawning and early rearing.

Weir information in conjunction with Idaho Department of Fish and Game and U.S. Forest Service observations of bull trout greater than 300 millimeters in length (12 inches) suggests that Crooked River likely harbors the greatest numbers of migratory bull trout in the South Fork Clearwater River watershed (CBBTTAT 1998a). The mainstem South Fork Clearwater River provides subadult and adult rearing habitat and FMO habitat for bull trout (CBBTTAT 1998a). It is also essential for connectivity of local populations within the core area to bull trout from other core areas within the recovery unit. Bull trout use the lower reaches of some tributaries of the South Fork of the Clearwater River as essential habitat for thermal refuge during high water temperatures in summer. The South Fork Clearwater River core area has connectivity to the Clearwater River shared FMO habitat, other Clearwater River core areas, and ultimately the Snake River and other core areas within the Lower Snake Geographic Area.

Primary threats identified within the South Fork Clearwater River core area are largely related to forest practices, roads, mining, transportation corridors, agriculture practices, grazing, and nonnative brook trout. Forest practices, roads, and mining legacy have led to instream degradation, sedimentation, loss of large woody debris, and pool reduction within SR habitats. Transportation corridors (historical and current) contribute to degradation in some SR tributary and mainstem FMO habitat. Agriculture practices and grazing have degraded habitat primarily within lower mainstem FMO habitats. Brook trout in some SR tributaries (*e.g.*, upper Crooked and Red Rivers), and mainstem FMO habitats contribute to competition, predation, range reduction, and possible hybridization with bull trout.

Additionally, numerous other core area threats to bull trout were identified but they are not considered to be primary threats. Fish passage (culverts) and water temperatures have contributed to fragmented habitat conditions within some watersheds in the core area. Fewer anadromous species (salmon, lamprey, etc.) have also led to a loss of or reduced prey base and nutrient inputs to the stream. Although population size was not identified as a primary threat, range reduction and fragmentation as a result of the primary threats listed above has decreased the number of local populations and resiliency of the core area population. Finally, while considered minor, some direct and/or incidental take from legal angling activities (bycatch), illegal poaching, and biological sampling occurs within the core area.

North Fork Clearwater River Core Area

The North Fork Clearwater River core area is located in Clearwater, Idaho, and Shoshone counties. It includes the North Fork Clearwater River and all its tributaries upstream of Dworshak Dam. The core area is approximately 632,360 ha (1,562,561 acres). Elevations range from 441 meters (1,445 feet) near the reservoir to 2,440 meters (8,000 feet) at the headwaters (CBBTTAT 1998b). Major tributaries within the core area include: North Fork Clearwater River, Elk, Little, Beaver, Quartz, Skull, Orogrande, Weitas, and Kelly Creeks (USFS 2000).

Bull trout are currently known to use SR habitat in at least 12 streams or stream complexes (*i.e.*, local populations). These local populations include the Kelly Creek Complex, Cayuse Creek Complex, Moose Creek Complex, Upper North Fork Clearwater River Complex, Weitas Creek Complex, Quartz Creek, Skull Creek, Isabella Creek, Little North Fork Clearwater River Complex, Floodwood Creek, Fourth of July Creek, and Fish Lake. Fish Lake which supports the core areas only naturally occurring adfluvial life history, was formerly a separate core area is now included within this core area. Based on redd counts as an indicator of the core area population trend for all streams in the North Fork Clearwater River core area, the population is increasing over the long-term (USFWS 2013; Meyer *et al*. 2014; Erhardt and Scarnecchia 2014).

Bull trout are widely distributed within the North Fork Clearwater River core area with bull trout redds documented in at least 33 streams associated with the 12 stream complexes identified above since 1994 (Hand *et al*. 2015). Redd count data for the core area suggests that the core area population has been stable since 2001 and results from redd counts in 2014 generally indicate a continued increase for most index reaches that were surveyed (Hand *et al*. 2015).

Prior to the construction of Dworshak Dam, bull trout likely migrated into the mainstem Clearwater River to overwinter, and mixed with other adults from the Lochsa, Selway, and South Fork Clearwater River core areas (USFS 2000). Bull trout also occupy Dworshak Reservoir and use it as rearing habitat for subadult and adult fish (CBBTTAT 1998b; CSS 2001; Schiff and Schriever 2004). The Idaho Department of Fish and Game has radio-tagged bull trout captured in Dworshak Reservoir and documented their spawning migration into headwater tributaries of the North Fork Clearwater River and their return to the reservoir for overwintering (Cochnauer *et al*. 2001; Schiff and Schriever 2004).

Primary threats were not identified for the North Fork Clearwater River core area. However, numerous threats were identified within the core area. These threats are largely related to forest practices and roads, transportation corridors, mining, water temperature, lost connectivity and entrainment at Dworshak Dam, reduced prey base, and nonnative brook trout.

Habitat related threats from forest practices and roads (legacy), have led to instream sedimentation and degradation within some SR habitats. Transportation corridors (historical and current) also contributed to habitat degradation in some SR tributary and mainstem FMO habitat. Water temperatures have contributed to temperature constraints in some FMO habitats and may contribute to fragmented habitat conditions within some watersheds in the core area. Instream impacts from current and legacy mining activities is considered minor but contributes to overall habitat loss with the core area. Finally, fewer anadromous species (salmon, steelhead, etc.) have also led to a loss of or reduced prey base and nutrient inputs to the stream.

Lost connectivity to Clearwater River shared FMO and nearby core areas, entrainment through Dworshak Dam and direct and/or incidental take from illegal poaching and legal angling activities contribute to demographic threats within the core area, but are considered minor overall. Lastly, nonnative brook trout in some SR tributaries and mainstem FMO habitats contribute to competition, predation, range reduction, and possible hybridization with bull trout in numerous watersheds within the core area.

Lochsa River Core Area

The Lochsa River core area is located in Idaho County and encompasses an area of approximately 303,024 ha (748,773 acres). Elevations range from 2,743 meters (9,000 feet) at the crest of the Bitterroots to 396 meters (1,300 feet) at Lowell, Idaho (USFS 1999b). The core area extends from the confluence of the Lochsa and Selway Rivers to the headwaters of Colt Killed and Crooked Fork Creeks which converge to form the Lochsa River. Major drainages in the Lochsa River core area include: Brushy Fork, Colt Killed (White Sands), Crooked Fork, Walton, Shotgun, Fishing, Legendary Bear, Post Office, Warm Springs, Lake, Split, Stanley, Boulder, Old Man, Fish, Hungry, Deadman, and Pete King Creeks. Approximately 60 percent of the core area is within designated Wilderness and Roadless areas. The main stem Lochsa River is designated as a Wild and Scenic River, and as such is protected from alterations to maintain its free-flowing and scenic characteristics.

Bull trout are currently known to use SR habitat in 17 streams or stream complexes within the Lochsa River drainage (*i.e.*, local populations). These local populations include Fishing, Legendary Bear, Boulder, Fox, Shotgun, Crooked Fork/Hopeful, Rock, Haskell, Colt Killed (White Sands), Beaver, Storm, Brushy Fork, Spruce, Twin, Walton, and lower Warm Springs Creeks and Fish Lake (USFWS 2015d; CBBTTAT 1998c; Watson and Hillman 1997; P. Murphy, pers. comm. 2002). Fluvial fish are thought to use the majority of SR habitat except for Spruce and Shotgun Creeks, which are likely resident populations due to migration barriers. Adult and subadult rearing is known to occur in the Lochsa River, lower Crooked Fork, Colt Killed, Walton, Warm Springs, Fish, Hungry, Weir, Post Office, Parachute, Doe, Coolwater, Fire, and Split Creeks (USFS 1999b, CBBTTAT 1998c). The most concentrated use of SR habitat by fluvial bull trout in the Lochsa River drainage occurs in Legendary Bear and Fishing Creeks (CBBTTAT 1998c). Bull trout are suspected to use nearly all accessible areas of the core area for subadult and adult habitat (CBBTTAT 1998c). The Lochsa River provides important foraging, migrating, and overwintering habitat for the local populations within the core area, and connectivity to bull trout populations in other core areas of the Clearwater River basin. Bull trout use the lower reaches of multiple tributaries of the Lochsa River as important habitat for thermal refuge during high water temperatures in summer. Fish Lake which supports the core areas only adfluvial life history, was formerly a separate core area is now included within this core area. The Lochsa River core area has connectivity to the Clearwater River shared FMO, other Clearwater River core areas, and ultimately the Snake River and other core areas within the Lower Snake Geographic Area.

Based on redd count, snorkeling, and screw trap data, the core area population trend for the Lochsa River Core Area is increasing over the long-term (Meyer *et al*. 2014). Total abundance for local populations in most of this core area is unknown at this time.

Primary threats were not identified for the Lochsa River Core Area. However, numerous other threats were identified within the core area. These threats are largely related to forest practices and roads, transportation corridors, water temperature, reduced prey base, and nonnative brook trout.

Habitat related threats from forest practices and roads (legacy), have led to instream sedimentation, a reduction of large woody debris and pools, and channel degradation within some SR habitats. Transportation corridors (historical and current) has also contributed to habitat degradation in some SR tributary and mainstem FMO habitat. Water temperatures have contributed to temperature constraints in some FMO habitats and may contribute to fragmented habitat conditions within some watersheds in the core area. Finally, fewer anadromous species (salmon and steelhead) have also led to a loss of or reduced prey base and nutrient inputs to the stream.

Direct and/or incidental take from illegal poaching and legal angling activities may contribute to demographic threats within the core area, but are considered minor overall. Lastly, nonnative brook trout in some SR tributaries and FMO habitats contribute to competition, predation, range reduction, and possible hybridization with bull trout in numerous watersheds within the core area.

Selway River Core Area

The Selway River core area is located in Idaho and Clearwater counties and includes the Selway River and all its tributaries upstream of the confluence of the Selway and the Lochsa Rivers. The core area encompasses approximately 520,242 ha (1,285,516 acres), the majority of which occurs in the Selway-Bitterroot and Frank Church-River of No Return Wilderness (USFS 1999c). Approximately 76 percent (395,791 ha or 978,000 acres) of the Selway River core area is within the Selway-Bitterroot Wilderness, and approximately 9 percent (47,365 ha or 117,040 acres) is within the Frank Church-River of No Return Wilderness (USFS 2001).

The Selway River originates in the Bitterroot Mountains on the Idaho-Montana border at an elevation of 2,778 meters (9,110 feet), and joins the Lochsa at Lowell, Idaho, at an elevation of 448 meters (1,469 feet) to form the Middle Fork Clearwater River. Major tributaries to the Selway River include: Moose, Bear, Whitecap, Running, Three Links, Marten, Gedney, O'Hara, and Meadow Creeks (USFS 1999c). Virtually all (99 percent) of the Selway River core area is administered by the U.S. Forest Service, which includes the Nez Perce, Bitterroot, and Clearwater National Forests (USFS 1999c). The Selway River is designated as a Wild and Scenic River, and as such is protected from alterations to maintain its free flowing and scenic characteristics.

The Selway River supports a significant metapopulation (an interacting network of local populations) of fluvial bull trout that are widely distributed through the core area in variable densities, as well as widely distributed resident local populations in some upper tributary reaches (USFS 1999c; USFS 2015). Local populations are well-connected within this core area do not exhibit the habitat fragmentation, isolation, and barriers that limit bull trout distribution and migration within much of the Columbia River basin (USFS 2015). Bull trout are currently known to use SR habitat in at least 10 streams or stream complexes (*i.e.*, local populations) within the Selway River drainage (CBBTTAT 1998c). These local populations include Meadow Creek Complex, Moose Creek Complex, Little Clearwater River Complex, Running Creek Complex, White Cap Creek Complex, Bear Creek Complex, Deep Creek Complex, Indian Creek Complex, Magruder Creek, and Upper Selway River Complex.

The status of the bull trout population is considered to be "strong" with bull trout numbers probably near historic levels (USFS 2015; ICRB 1997). While total abundance is unknown for the Selway River Core Area, the core area likely contains bull trout populations consisting of several thousand individuals in each stream, with at least 500 adults in each stream (USFS 2015). Migratory subadult and adult bull trout reside in the mainstem of the Selway River (USFS 2015). Bull trout are suspected to use nearly all accessible areas of the core area for subadult and adult habitat (CBBTTAT 1998c). Bull trout use the lower reaches of some tributaries of the Selway River as essential habitat for thermal refuge during high water temperatures in summer. The Selway River provides important foraging, migrating, and overwintering habitat for the local populations within the core area, and connectivity to bull trout populations in other core areas of the Clearwater River basin. The Selway River Core Area has connectivity to the Clearwater River shared FMO, other Clearwater River core areas, and ultimately the Snake River and other core areas within the Lower Snake Geographic Area.

Primary threats were not identified for the Selway River core area. However, numerous other threats were identified within the core area. These threats are largely related to sediment, water temperature, reduced prey base, and nonnative brook trout.

Habitat related threats from sedimentation and water temperatures is considered minor within the core area and primarily affects FMO habitat in the lower reaches of the Selway River. Fewer anadromous species (salmon, steelhead, etc.) have also led to a loss of or reduced prey base and nutrient inputs to the stream.

Direct and/or incidental take from illegal poaching and legal angling activities contribute to demographic threats within the core area, but are considered very minor overall. Lastly, nonnative brook trout are present in this core area primarily in the lower to middle tributaries below Running Creek, and may contribute to competition, predation, range reduction, and hybridization with bull trout within the core area. Threats from brook trout are also considered to be minor considering the wide spread and strong populations throughout much of the core area.

Tucannon River Core Area

The Tucannon River originates in the Wenaha-Tucannon Wilderness Area of the Blue Mountains in southeastern Washington and drains approximately 1,303 square km (503 square miles) (CCD 2004; Faler *et al*. 2008). The Tucannon River enters into the Snake River at river km 99.8 (river mile 62), upstream of Lower Monumental Dam and downstream of Little Goose Dam (USFWS 2000). Several tributaries feed the Tucannon River, including Pataha, Kellogg, Willow, Tumalum, Cummins, and Panjab Creeks (CCD 2004; Bilhimer *et al*. 2010; Anchor 2011). Current and historical land uses throughout the basin include dry and irrigated cropland, sheep and cattle rangeland, logging, recreation, and low yield mining (CCD 2004). Much of the headwaters on the mainstem Tucannon River remain in public lands under management of the U.S. Forest Service and the Washington Department of Fish and Wildlife Wooten Wildlife Area.

Bull trout still occupy most of their historic range in the Tucannon River watershed, and prior to 2000 the population of the core area was considered relatively large (USFWS 2010). Genetic analyses indicate that there are currently five local populations of bull trout, and possibly a sixth, within the core area of the Tucannon River watershed (USFWS 2008; Kassler *et al.* 2013). These local populations are fairly isolated from local populations in other regional tributaries of the Walla Walla River, Clearwater River, and Asotin Creek (USFWS 2010). Both resident and migratory forms of bull trout still occur in the Tucannon River watershed (Martin *et al*. 1992; WDFW 1997) and recent data indicate that migratory bull trout from the Tucannon

River regularly use the mainstem of the Snake River on a seasonal basis (Underwood *et al*. 1995; WDFW 1997; Faler *et al.* 2008; Bretz 2010; D. Wills, pers. comm. 2014).

Between 2000 and 2007, redd counts and capture records suggest that populations in the Tucannon River had undergone a pronounced decline. For example, the average number of redds documented annually in the upper watershed dropped from over 100 during the early 2000s to less than 20 by 2007 (Mendel *et al*. 2008; Bretz 2011), while the number of migrating bull trout documented annually at the Tucannon Hatchery trap declined from over 250 to approximately 50 during the same time period (Mendel *et al*. 2008; Bretz 2011). Many of the bull trout captured in 2007 were also considered in poor health with new or recent injuries (cuts and scrapes) around their heads and gills. The cause(s) of this decline and the poor condition of some of the captured fish are unknown, although two large fires occurred in the Tucannon River watershed during the mid-2000s that resulted in higher sediment delivery to streams in the core area (USFWS 2008). Over this time period, the decline of bull trout may coincide with a reduction in migratory fish due to fish age or as a result of seasonal migration barriers preventing returns (Bretz 2011). Loss of nutrients, a declining prey base from dwindling anadromous salmonid populations, and physical (*e.g.*, dams, fences, nets, weirs) or temperature barriers in the mainstem Tucannon River and its tributaries are also likely contributing factors. More recent information indicates that the Tucannon River population may have rebounded somewhat since 2007, with over 230 bull trout observed during trapping and survey activities in 2013 and recent redd count data (WDFW 2014).

The local populations of bull trout within the Tucannon River watershed can still generally move freely among their natal streams (USFWS 2008). However, several partial, seasonal or potential barriers exist throughout the basin and movement between core areas is hindered by dams on the Snake River. The Tucannon Hatchery trap, located at river km 58 (river mile 36), is a partial barrier to bull trout movements during the trapping season from January to September. In addition, rock and debris dams created by recreationalists on several Tucannon River tributaries have been known to block migration of bull trout in the watershed (Faler *et al*. 2008). Other ongoing threats include flood control, crop production, irrigation withdrawals, livestock grazing, logging, hydropower production, management of non-native fish species, recreation, urbanization, and transportation networks (USFW 2008; Anchor 2011).

Asotin Creek Core Area

Originating out of the Blue Mountains in southeastern Washington, Asotin Creek drains a total area of approximately 83 square km (20,660 acres) and includes 524 km (326 miles) of perennial and intermittent streams (Kuttel 2002). Asotin Creek enters the Snake River near Clarkston, Washington at river km 234 (river mile 145), and approximately 56 km (35 miles) upstream of Lower Granite Dam (Kuttel 2002; Barrows *et al*. 2015). Main tributaries to Asotin Creek include George, Charley, North Fork Asotin, Pintler, and South Fork Asotin Creeks (Kuttel 2002; Barrows *et al.* 2015). Land use through the basin consists of residential, agricultural, and public land uses. The majority of the Asotin Creek headwaters are found on public lands in the Umatilla National Forest and in the Asotin Creek Wildlife Area managed by Washington Department of Fish and Wildlife (WDFW 2006). The Asotin Creek Wildlife Area, managed by WDFW, includes three non-contiguous units (Asotin Creek, George Creek, and Weatherly) within the forks and tributaries of Asotin Creek and George Creek (WDFW 2006).

Within the Asotin Creek core area, there is one known local population in North Fork Asotin Creek, which includes Cougar Creek (Kassler and Mendel 2008; J. Trump, pers. comm. 2015). Abundance information and redd count data indicate that the population is very small and likely at critical levels (Marten *et al*. 1992; Underwood *et al*. 1995; Mendel *et al*. 2006; J. Trump, pers. comm. 2015; Barrows *et al*. 2015). Redd counts in North Fork Asotin and Cougar Creeks ranged from 10 to 13 in survey years 2005, 2006, and 2012 (J. Trump, pers. comm. 2015). Current data suggest that the population consists of both resident and migratory forms of bull trout in the Asotin Creek Core Area (Kassler and Mendel 2008; Mayer and Schuck 2004; Mayer *et al*. 2006; Crawford *et al.* 2011; Barrows *et al.* 2015). However, data also suggests that instream conditions may seasonally limit movement of migratory bull trout in the basin (Barrows *et al*. 2015). While studies have shown movement of bull trout throughout the Asotin Creek Core Area (Barrows *et al*. 2015) low instream flows, intermittent flows with areas of subsurface flows, and a partial to full passage barrier at Headgate Dam (river km 6 [river mile 9]) impact the persistence of migratory bull trout and reduce connectivity between tributaries within the core area.

Legacy effects of cattle and sheep grazing, forest practices, transportation and recreation affect water quality, sedimentation, and channel complexity throughout the core area (Kuttel 2002). Extensive flood damage to the channel and riparian zone in the mid-1990's are still apparent in George Creek (Ullman and Barber 2009). Many of these effects in the tributaries are being addressed through watershed planning and implementation processes and other mechanisms (WDFW 2006; Ullman and Barber 2009; Middle Snake Watershed Planning Unit 2011; WDOE 2011). The quality of FMO in the Snake River as well as habitat in the headwaters may be very important to the persistence of bull trout in Asotin Creek and therefore reduction of risk from catastrophic wildfires or other stochastic events is needed.

Little Minam River Core Area

The Little Minam River core area is located in northeast Oregon within the Grande Ronde River Basin and is a tributary to the Minam River. The core area is located entirely within the Eagle Cap Wilderness on the western edge of the Wallowa subbasin, in both Union and Wallowa counties. This core area contains a single local population which exists in multiple tributaries above a barrier waterfall at approximately river km 9 (river mile 5.6). The Little Minam River below the barrier to the confluence with the Minam River is not part of this core area. Bull trout above the barrier falls occupy habitat in the following areas: 15.1 km (9.4 miles) of the Little Minam River, 0.6 km (0.4 mile) of Boulder Creek, 0.8 km (0.5 mile) or less of Horseshoe Creek (Miller, USFS, pers. comm. 2011) and 5.1 km (3.2 miles) of Dobbin Creek.

The Little Minam River core area contains a healthy resident population (an average of 306 redds from 1997 to 2004, or 27 redds/mile) distributed in excellent habitat protected within the Eagle Cap Wilderness. While there is no recent survey information, the population is considered stable with no primary threats. The only concern is catastrophic fire and other stochastic events which could impact this core area due to its limited distribution and isolation above a barrier.

Lookingglass/Wenaha River Core Area

The former Grande Ronde River core area (in the 2004 draft recovery plan) was subdivided into three core areas based on the distribution patterns determined from telemetry studies of bull trout from the Wenaha and Lostine Rivers and Lookingglass Creek, differences in the environmental characteristics among the subdivisions, and the likelihood for genetic exchange and demographic linkage given the size of the Grande Ronde River basin.

Lookingglass Creek is near the town of Elgin, Oregon and the Wenaha River which is designated as a Federal Wild and Scenic River, is near the town of Troy, Oregon. The Wenaha-Tucannon Wilderness is located in the Umatilla National Forest, encompasses 718 square km (177,465 acres) and includes most of the Wenaha River drainage, which is still recovering from legacy effects associated with past logging, along with domestic sheep and cattle grazing. Lookingglass Creek is located largely within a designated roadless area and is a spring-fed drainage that maintains cool water temperatures year-round.

Local bull trout populations in this core area include: 1) North Fork Wenaha River; 2) South Fork Wenaha River (including the Wenaha River); 3) Butte Creek and West Fork Butte Creek; and 4) Lookingglass Creek. These four local populations are spread over a large geographical area with multiple age classes, containing both resident and fluvial fish. Distribution for this core area includes a total of approximately 24 stream km (15 stream miles) in the Lookingglass drainage (4.5 km [2.8 miles] of spawning and rearing habitat and 19.6 km [12.2 miles] of FMO). The Wenaha River system has approximately 82.6 km (51.3 miles) of occupied bull trout habitat. Bull trout distribution in the Wenaha River includes; 1) mainstem Wenaha River (34.9 total km [21.7 miles] including 16 km [10 miles] of FMO in the lower river and 18.8 km [11.7 miles] of spawning and rearing habitat); 2) North Fork Wenaha River includes 18.8 km (11.7 miles) spawning and rearing habitat; 3) SF Wenaha River has 13.0 km (8.1 miles) spawning and rearing habitat; 4) West Fork and East Fork Butte Creeks have 4.2 km (2.6 miles) spawning and rearing habitat; and 5) Butte Creek has 11.6 km (7.2 miles) of spawning and rearing habitat.

In general, there is a high level of uncertainty about the trend of the four local populations, especially for the populations within the Wenaha River. The Lookingglass Creek redd counts have had a range of 15 to 69 (average of 44.5) redds for approximately 6 km (4 miles) of survey from 1994 to 2010. The Lookingglass local population is estimated to be stable based on the trend of redd counts. There are insufficient data available to make inferences about abundance of bull trout and to conclude population stability or trend in the entire Wenaha River system (G. Mendel, WDFW, pers. comm., 2008; and B. Knox, ODFW, pers. comm. 2011). Information is available regarding the relative abundance of bull trout in northern tributaries of the Wenaha River within Washington State (Mendel *et al*. 2006, 2008). The North Fork Wenaha River within Washington has bull trout redd counts of 82 and 86 (both partial counts) in 2006 and 2007 respectively, and 153 redds in 2005, and 112 in 2010 (G. Mendel, pers. comm. 2011). Butte Creek and the West Fork of Butte Creek also have bull trout redd counts (of 31 and 32 redds, respectively) in 2005 and 2006, although the survey areas were not exactly the same during the 2 years.

Imnaha River Core Area

The Imnaha River core area is located in the Imnaha River subbasin in Oregon, in the northeastern corner of Oregon, and drains an area of 2,202 square km (850 square miles). The Imnaha River flows in a northerly direction and is a direct tributary to the Snake River, where it joins the Snake River at river km 308.5 (river mile 191.7), approximately 77 river km (48 river miles) upstream of Lewiston, Idaho. The headwaters of the Imnaha River drain the eastern escarpment of the Wallowa Mountains and originate within the Eagle Cap Wilderness. The Imnaha Core Area is diverse in elevation and topographic relief. Elevations range from nearly 3,050 meters (10,000 feet) in the Wallowa Mountains to 300 meters (975 feet) at the confluence with the Snake River. Approximately 71 percent of the Imnaha River basin is under public ownership. The majority of the basin lies within the Wallowa-Whitman National Forest. Twenty four percent of the subbasin is privately owned. Forest and ecosystem management, transportation, recreation, wilderness, and agriculture are primary forms of land use in the subbasin (Ecovista 2004, USFWS 2002).

Currently, this core area contains eight local populations spread over a large geographical area with multiple age classes, containing both resident and fluvial fish. The minimum estimate of adult bull trout abundance for this core area is approximately 1000 to 2500 individuals. The Wallowa Valley Improvement Canal (WVIC) limits bull trout connectivity in the Big Sheep Creek, Little Sheep Creek, and McCully Creek populations. There are current fish passage, fish screening, and instream flow concerns as a result of this diversion that may limit fluvial life history expression and/or connectivity. The Imnaha Falls is a natural upstream barrier to fluvial bull trout depending on annual flow conditions. Hatchery weirs and intakes (at Imnaha satellite (river km 74 [river mile 46]) and Little Sheep Creek satellite (river km 8 [river mile 5])) may also be impacting bull trout in this core area by affecting migration, spawning timing, and distribution.

The Imnaha River Core Area populations are generally stable; especially the Imnaha River population. Little Sheep was rated at high risk of extinction (Buchanan *et al*.1997) and there is limited abundance data available for these populations. The Service sampled bull trout in Upper Little Sheep Creek in 2010 and captured very few fish between the 3920 Forest Road and the forks, and captured no fish above the forks (a large portion of which was affected by the 1989 Canal Fire). Distribution and abundance appears to be extremely limited in the Upper Little Sheep population (M. Hudson, USFWS, pers. comm. 2011). The 10-year average from 2001 to 2010 was 193 redds for the Imnaha River (Upper Imnaha River and tributaries). Total redds numbers on the Imnaha ranged from 101 to 262 within that period for 28.2 km (17.5 miles) of stream. The 11-year average from 2000 to 2010 was 18 redds for the Big Sheep system for 14.8 km (9.6 miles) (includes Big Sheep and Lick Creek). Total redd numbers within the Big Sheep system ranged from 8 to 34 for that period (Sausen 2011). Current abundance data (redd count and/or electrofishing data) are available for the Imnaha River, Big Sheep Creek, and McCully Creek local populations and they suggest relatively high abundance and/or stable trends (Cook and Hudson 2008, Sausen 2011).

Middle Snake Geographic Region – Mid-Columbia Recovery Unit

Powder River Core Area

The Powder River core area is located in Baker, Union, and Wallowa Counties in Oregon and encompasses an area of approximately 426,675 ha (1,054,314 acres). Elevations range from 549 meters (1,800 feet) to 2,774 meters (9,101 feet) in the Blue Mountains. The core area extends northwest from the mouth of the Powder River on the Snake River to the Wallowa Mountains in Oregon, west to the Blue Mountains, south along the ridgeline to the Malheur basin, east to the Brownlee Reservoir on the Snake River, and northeast to Brownlee Reservoir. Tributaries known to be inhabited by bull trout in this core area include: Big Creek, Wolf Creek, Indian Creek, Anthony Creek, North Powder River, Rock Creek, Cracker Creek, Lake Creek, Salmon Creek, and McCully Fork Creek.

The core area includes a mixture of private and public lands. Approximate percentages of land ownership within the core area are 63.5 percent private, 36 percent Federal, and 0.5 percent State of Oregon. Federal land managers within the Powder River core area include the Wallowa-Whitman National Forest and the Bureau of Land Management. Reaches of the Powder River and North Powder River have been designated as Wild and Scenic by the U.S. Forest Service and the Bureau of Land Management.

During 2013-2015, the distribution, relative abundance, and extent of hybridization of bull trout and brook trout populations in the Powder River Basin were extensively sampled in most of the streams where bull trout were previously documented or thought to occur and compared with similar surveys conducted during the 1990s (Howell 2013 and unpublished data). No extirpations have occurred; however, in most streams the bull trout distribution is limited to a few kilometers at the upper limits of fish distribution. Only three populations occur in streams where brook trout are not present.

Pine/Indian/Wildhorse Core Area

The Pine/Indian/Wildhorse core area is located in Baker and Union Counties in Oregon and in Adams County in Idaho. In Oregon, it includes Pine Creek and its tributaries. In Idaho, it includes Indian Creek and Wildhorse River and all their tributaries. The core area is approximately 111,284 ha (274,982 acres). Elevations range from 456 meters (1,496 feet) at the Hells Canyon Reservoir to 2,774 meters (9,101 feet) at the summit of Granite Mountain in the headwaters of Pine Creek (Saul *et al.* 2001). The core area extends from the Seven Devils Mountains in Idaho, west to the Wallowa Mountains in Oregon, south to the hydrological divide between Pine Creek and the Powder River, and southeast to Brownlee Dam and Cuddy Mountain in Idaho. The core area is divided by the Snake River, which generally flows from south to north in this reach and forms the border between Idaho and Oregon. Major tributaries within the core area include Clear Creek, East Pine Creek, Fish Creek, Elk Creek, and North Pine Creek in Oregon, and Bear Creek, Lick Creek, and Crooked River in Idaho. North Pine Creek and Duck Creek and portions of Elk Creek and Fall Creek are in the Hells Canyon National Recreation Area.

Although the genetic composition of bull trout in the two tributaries in Idaho has not been extensively studied, the streams were included in the core area due to their close proximity to the tributaries in Oregon containing bull trout and the likelihood of historical interactions. Administratively, the ODFW established a working group to develop bull trout conservation strategies in the Pine Creek and Powder River basins, and the streams in Idaho were included in the Hells Canyon Key Watersheds in the Idaho Bull Trout Conservation Plan (Grunder 1999).

The majority of lands in the Indian Creek and Wildhorse River watersheds of Idaho are federally owned (Grunder 1999). About 90 percent of the area in Indian Creek (ID) is administered by the Payette National Forest, and over half of the area in the Wildhorse River watershed is administered by the Payette National Forest and Bureau of Land Management. However, a substantial amount of private land occurs along Bear Creek, a tributary of Wildhorse River. Portions of the Pine Creek drainage in Oregon as well as the Indian Creek and Wildhorse River drainages in Idaho are within the lands ceded by the Nez Perce to the Federal government. The tribe maintains treaty rights to hunt, fish, gather, and pasture horses and livestock in these areas (Statler *et al.* 2001).

Bull trout are currently known to use spawning and rearing habitat in at least seven streams or stream complexes in the Pine-Indian-Wildhorse core area. These include Indian Creek (ID), Bear Creek, Crooked River, Upper Pine Creek, Clear Creek, East Pine Creek, and Elk Creek (Buchanan *et al.* 1997). Both Bear Creek and the Crooked River are tributaries to Wildhorse River. Bull trout occupancy in Upper Pine Creek includes West Fork Pine, Middle Fork Pine, and East Fork Pine Creeks. Occupancy in Clear Creek includes Trail and Meadow Creeks. Occupancy in Elk Creek includes Aspen, Big Elk, and Cabin Creeks. The length distribution of bull trout surveyed from various streams in the Pine Creek basin during 1994 (Buchanan *et al.* 1997), and the limited pre- and post-spawning movements exhibited by radio-tagged fish (Chandler *et al.* 2001a) suggest that most bull trout in the basin are resident fish. However, the movement of radio-tagged bull trout from Hells Canyon Reservoir to Pine Creek indicates that migratory fish may persist in the basin (Chandler *et al.* 2001b).

Historic Core Areas and Mainstem Foraging/Migration/Overwintering (FMO) Habitats

The following sections contain information on mainstem FMO segments present in the Mid-Columbia Recovery Unit, as well as information on the two historic core areas; Chelan and Eagle Creek historic core areas.

Lake Chelan Historic Core Area and Chelan River Mainstem FMO Area

Lake Chelan is located in Chelan County and is a historic core area. Bull trout are considered to be functionally extirpated (USFWS 2002) and reasons for their disappearance in the lake remains uncertain (Nelson 2012). The basin is located in north central Washington and within Chelan County. It is bordered by the Cascade Mountains to the west, and the Columbia Plateau to the east. It is bordered on the north by the Sawtooth Mountains and on the south by the Entiat and Chelan Mountains and the Glacier Peak Complex. Elevations range from over 9,000 feet (2,700 meters) above sea level at the crest of the Cascade Mountains to 700 feet (210 meters) on the Columbia River (FERC 2001). From Twentyfive Mile Creek up-lake, the terrain is mountainous and rugged with glacial features such as cirques, truncated spurs, moraines, horns, and U-shaped valleys with minimal flat beaches or shoreline.

Lake Chelan, comprising approximately 81 km (50.4 miles) of the 120-km (75-mile) long basin, is the third deepest freshwater lake in the nation (FERC 2002), and the largest and deepest natural lake in Washington. The lake consists of two basins: the Lucerne basin, which is deep and fjord-like and extends north from an area called “The Narrows” for 61 km (38 miles) downlake; and the Wapato basin, which is relatively wide and shallow in comparison (max. depth of 120 meters [400 feet]) and extends downlake for 19 km (12 miles) to the outlet. The lake has an average width of 2.4 km (1.5 miles) and a maximum depth of 453 meters (1,486 feet), and it drains 2,393 square km (924 square miles). Water from Lake Chelan is relatively very cold and flows from its southern end at the Lake Chelan Dam into the 6.6-km (4.1-mile) long Chelan River, known as the shortest river in Washington. This river falls 400 feet (120 meters) in its descent through a steep, rocky gorge to the Columbia River (FERC 2002). The upper portion of the Chelan subbasin is within the North Cascades National Park, the Lake Chelan National Recreation Area, and National Forest and is likely to be the best habitat for bull trout. This area contains the superfund site at the town of Holden for Holden Mine, currently in the process of restoration. The middle part of the basin is in the mostly managed by the Okanogan-Wenatchee National Forest. Most of the lower basin, which contains the majority of the development, is privately owned. The basin lies within areas of usual and accustom areas for the Yakama Nation and Colville Confederated Tribes. The management of Lake Chelan has included removal of large wood, fluctuating reservoir levels causing a lack of access to tributaries in some years, large scale agriculture and pesticide use including historical use of DDT, large developments and recreational fisheries, and the introduction of several non-native species including: mysid shrimp, kokanee, chinook salmon, and coastal rainbow, Yellowstone cutthroat, brook, and lake trout, all of which may have impacted native fish populations.

Although Lake Chelan is a natural lake its water level and discharge via the Chelan River has been controlled by Lake Chelan Dam since construction was completed in 1927 (FERC 2002). After construction, the lake levels rose by 21 feet (6.4 meters) and the river was generally always dry. The discharge water from the lake is very cold and forms the Chelan River. The river's water is used for hydroelectric power, irrigation, and drinking water. In addition, during the summer the water level of Lake Chelan is maintained at a relatively high elevation for scenic and recreational purposes. The water is diverted through a 3.5-km (2.2-mile) long power tunnel, which ends with a 401-foot (122-m) drop through turbines at the powerhouse near its mouth at the Columba River. Most of the Chelan River's "bypassed reach" is owned by Chelan County PUD, the utility which also owns and operates Lake Chelan Dam. In 2009 the release pattern from the Lake Chelan Dam has allowed the Chelan riverbed to hold water again and allow for year-round use by salmon and bull trout. Anadromous fish are thought not to have made it above the natural cascades/falls in the Chelan River, although rainbow in upper areas are known to have the native redband genes (Mullan *et al.* 1992).

The Lake Chelan basin is historic adfluvial migratory bull trout habitat, but their presence has not been documented since the late 1950's, and they may have been extirpated from the basin (WDFW 2000; Brown 1984). Bull trout are not thought to be able to move upstream above the barriers that exist in the Chelan River canyon today, and the populations in the lake may have been a glacial remnant population. Complete surveys in remote tributary reaches of the Lake Chelan basin have not been fully conducted (Halupka *et al*. 2002, Nelson 2012), however, and further investigation is needed. Anecdotal information suggests that there may still be some small pockets of bull trout in the upper Stehekin watershed (P. Archibald, pers. comm. 2009). Chelan Dam relicensing requires establishment of native fish populations in Lake Chelan (USFWS 2003, CCPUD 2003 and WDFW has a Lake Chelan Management Plan that describes reintroduction of native fish including bull trout. Efforts to survey for bull trout need to occur prior to any re-introductions. Lake Chelan, even with the presence of lake trout, has the potential to eventually support resident, fluvial, and adfluvial bull trout if primary threats are addressed or even reduced. This watershed has not previously been described as a separate core area, and is not currently known to support an established population. However, as climate change occurs, Lake Chelan could be an area that would aid bull trout recovery as a refugial habitat due to maintenance of cold water.

Separately, the Chelan River supports fluvial life history forms of bull trout from its confluence upstream to the Chelan Dam. However it is unknown how much area is used by bull trout. It is suspected that the majority of bull trout use the lower 0.82 km (0.51 mile) of habitat as cold water refuge and forage, migration and overwintering habitat. This area can provide habitat for any bull trout using the Columbia River, (*i.e.*, from the Wenatchee, Entiat, and Methow core areas). Bull trout have been observed using the area during radio telemetry studies and other snorkeling efforts (R2 Resource Consultants *in litt*. 1999; R2 Resource Consultants 2000; USFWS 2003; BioAnalysts 2004). Climate change may have added impacts to forage, migration, and overwintering habitat and connectivity will be key for recovery. Cold water flowing into the Columbia River from the Chelan River will be key for maintaining places of refugia for bull trout using the Upper Columbia Geographic area during climate change.

Eagle Creek Historic Core Area

The Eagle Creek historic core area encompasses the entire Eagle Creek watershed including Eagle, East Fork Eagle, and West Eagle Creeks. Eagle Creek is a tributary of the lower Powder River and drains into the Snake River through Brownlee Reservoir. Eagle Creek, East Fork Eagle Creek, and West Eagle Creek are largely located on the Wallowa-Whitman National Forest, partially occurring in the Eagle Cap Wilderness Area.

The Eagle Creek watershed historically supported numerous bull trout (Gildemeister 1992, Pratt *et al*. 2001). There are creel reports from 1965 and angler reports during the mid-1980's of bull trout in Eagle Creek (Buchanan *et al*. 1997). More recently there are multiple anecdotal reports of bull trout in the Eagle Creek watershed, including a report from 2000 of a bull trout in Eagle Creek near the confluence of Little Eagle Creek and another report of bull trout in Summit Creek (S. Fouty, pers. comm. 2003; J. Zakel, pers. comm. 2003). However, extensive surveys in 1991 and 1994 did not detect bull trout (Buchanan *et al*. 1997).

Numerous tributaries and reaches within the watershed currently provide suitable spawning and rearing habitat for bull trout. The upper reaches of main Eagle Creek, East Fork and West Fork Eagle Creeks are located in the Eagle Cap Wilderness and contain nearly pristine habitat conditions and water quality (Buchanan *et al*. 1997). Anderson (1995) rated reach 1 of East Eagle Creek and Two Color Creek as being likely to support bull trout. Grove Creek, multiple reaches of West Eagle Creek, and mainstem Eagle Creek were reported as possibly capable of supporting bull trout (Anderson 1995). Foraging, migratory, and overwintering habitat exists in the lower mainstem of Eagle Creek, the Powder River and Brownlee Reservoir.

The Eagle Creek historic core area has the potential to eventually support both resident fluvial and adfluvial bull trout if primary threats are addressed. Threats to the potential recolonization or reintroduction of bull trout in Eagle Creek include connectivity impairment, poor water quality, land management practices and brook trout. Passage issues and entrainment caused by irrigation structures and activities impede connectivity. Low flows, dewatering, and warm stream temperatures impact water quality particularly in the lower reaches. Grazing, agricultural practices and timber harvest activities have affected quality of instream and riparian habitats. Brook trout pose a serious risk for hybridization and as competition to bull trout.

Okanagan River FMO

The Okanogan River is within Okanogan County and joins the Columbia River at river km 858.6 (river mile 533.5), between Chief Joseph and Wells dams, near the town of Brewster, Washington and straddles Canada and Washington at Osoyoos Lake. The Okanogan River originates in British Columbia, Canada, and flows south through a series of three large, and one small lake before reaching the United States border. Seventy-four percent of the basin is in British Columbia, and 26 percent is in Washington State. The basin covers approximately 21,000 square km (8,200 square miles), with 6,500 square km (2,500 square miles) or approximately 30 percent of the watershed in the United States. The eastern and western boundaries are steep, jagged, forested ridges at elevations ranging from 1,500 feet (460 meters) to over 5,000 feet (1,500 meters) above the basin floor. Tiffany Mountain is the highest peak in the drainage, at 8,242 feet (2,512 meters) above sea level. The coastal and Cascade Mountains cast a rain shadow on the basin, creating the dry climates associated with this most northern extension of the western American deserts. Precipitation in the watershed ranges from more than 40 inches (100 centimeters) in the western mountain region to approximately 8 inches (20 centimeters) at the confluence of the Okanogan and Columbia Rivers. The largest tributary in Washington is the Similkameen River, located primarily in Canada, contributes 75 percent of the flow to the Okanogan River. Omak and Salmon Creeks are other important tributaries for salmonids. Forestry, grazing, and agriculture are the major uses in the Okanogan basin in the United States. Stream flow in the mainstem Okanogan River is affected by a series of dams and channelization projects dating back to 1920 and fishery needs are negotiated annually by fisheries and irrigation managers from both Canada and the United States (Okanogan Subbasin plan, 2004). Zosel Dam flows are operated under the auspices of orders set out by the International Joint Commission. Approximately 14,600 to 16,200 ha (36,000 to 40,000 acres) of irrigated lands are in the United States portion of the subbasin. About 60 percent of that acreage (9,883 ha [24,421 acres]) is contained within irrigation districts or ditch companies (Okanogan Subbasin plan, 2004). Fish passage is not blocked in the United States portion of the Okanogan

River and Zosel Dam (river km 126 (river mile 78) is passable by fish. Passage for anadromous fish is still blocked in Canada, but there are ongoing efforts to remove fish barriers. Landownership includes the Colville Tribal Reservation, U.S. Forest Service, BLM, State, and private lands. As well this basin is part of the usual and accustomed areas for the Colville Tribe.

Fisheries habitat is limited in summer by a combination of low flow and high temperatures and in Osoyoos Lake by low oxygen levels and high water temperatures near the surface. Intolerable conditions in Osoyoos Lake may be partially or totally responsible for the disappearance of the returning sockeye between Wells Dam and the Canadian spawning grounds.

One of the limiting factors for focal fish species within the lakes of the Okanagan is the shrimp *Mysis relicta*. Introduced into Okanagan Lake as a food source for kokanee in 1966, they have slowly emigrated downstream and they have colonized Osoyoos Lake about 5 years ago.

Numbers in Osoyoos Lake are thought to be increasing and managers are concerned that competition for food and space might adversely impact sockeye salmon. Control measures involving harvesting of mysids are being tried experimentally on Okanagan Lake and the results may be useful in managing Osoyoos Lake.

Bull trout are known to occur in the Okanogan River in British Columbia (McPhail and Carveth 1992). The current distribution is unknown. In general, this is a watershed that supports foraging, migration, and overwintering areas for bull trout. Recently since the last draft recovery plan in 2002, bull trout have been observed in the mainstem Okanogan River during radio-telemetry studies and in PIT tag encounters that came from the Methow and the Wenatchee (*i.e.*, Chiwawa) Rivers (BioAnalysts 2004, PTAGIS 2015, M. Nelson, pers. comm. 2015). Bull trout have also been observed passing through the fish ladder in Zosel Dam at Osoyoos Lake in 2005 and 2006, and most recently in Omak Creek (B. Nine, Colville Confederated Tribe, pers. comm. 2015). No spawning areas have been located, but surveys have not been fully conducted. Recent improvements in habitat and passage may facilitate further migration and foraging of bull trout from other core areas into the Okanogan River. Climate change may have added impacts to forage, migration, and overwintering habitat and connectivity will be key for recovery. Connectivity into colder Canadian waters may improve forage, migration, and overwintering habitat for bull trout that use the Upper Columbia Geographic Area. Currently, the Okanogan River is considered important to bull trout recovery because of its ability to provide for foraging, migration, and overwintering habitat.

John Day River FMO

The John Day River mainstem FMO reach begins at the river's confluence with the Columbia River and extends upstream to its confluence with the North Fork John Day River. The mainstem John Day FMO segment during the summer and fall can be inhospitable because of temperature and flow conditions, although use and access to the Columbia River is likely during late fall, winter and spring. Bull trout in the John Day River Basin exhibit both resident and fluvial life histories. Little is known about bull trout abundance, distribution, and seasonal-use or migration patterns in the lower mainstem of the John Day River. However, survey work by the Oregon Department of Fish and Wildlife (Hemmingsen *et al*. 2001) detected bull trout in the mainstem John Day River at river km 273 (river mile 170) near the town of Spray and downstream of the confluence with the North Fork John Day River at river km 295 (river mile 183). In the upper John Day River fluvial fish have been observed as far downstream as the John Day visitor center at Sheep Rock (USFWS 2008) and in the lower Middle Fork John Day River near Ritter (Unterwegner 2003).

The John Day River FMO habitat is important to bull trout recovery because it ensures connectivity among the basin's three core areas which promotes redundancy in local populations, protects against the effects of stochastic events, and supports life history diversity by supporting habitat for the migratory life history form. Unlike most river basins in Oregon, there are no major dams in the John Day Basin. Seasonal barriers occur during periods of low flow and thermal barriers occur during the summer. However, all three core areas are connected to one another through FMO habitats. There is a potential for bull trout to migrate to the Columbia River. In 2002, a bull trout was captured in the juvenile bypass facility at John Day Dam. Although its origin is unknown at this time, it could have been from the John Day River as this is the closest bull trout population upstream of the dam.

Currently, there is no monitoring of bull trout in the lower mainstem of the John Day River although, as noted above, it is presumed to be used by bull trout for foraging, migration and overwintering. Future monitoring should investigate the extent and timing of bull trout use of the lower mainstem John Day River and associated tributaries.

Mainstem Columbia River and Snake River FMO

The mainstem Columbia River forage, migration and overwintering (FMO) area within the Mid-Columbia Recovery Unit spans the area between John Day Dam upstream to Chief Joseph Dam in Washington and Oregon. The mainstem Snake River FMO extend upstream from the confluence with the Columbia River to Brownlee Dam in Idaho. The majority of the lands along the Columbia River are privately owned. The majority of the land uses include agriculture, livestock grazing, suburban development. A lower portion of lands are managed by Federal, State and county governments. Hydropower generation occurs at seven Columbia River mainstem dams (John Day, McNary, Wanapum, Priest Rapids, Rock Island, Rocky Reach, Wells, and Chief Joseph Dams) and downstream impacts from Grand Coulee dam are realized. There are also five hydropower dams in the lower Snake River (Ice Harbor, Lower Monument, Little Goose, Lower Granite, and Brownlee dams). Several large irrigation projects are managed within these mainstem areas. Fish passage is generally open year-round where available, while McNary and lower Snake dams transports fish in barges downstream. Many roads and railroads stand adjacent to the river corridor reducing off channel habitat and overall complexity. Water quality ranges from extraordinary to poor and exceedances to water quality standards occur according to the 2004 Upper Middle Mainstem and Mid-Columbia Mainstem and Subbasin Plans. These plans describe that summer temperatures often exceed the maximum water temperatures (18 to 20 degrees C [64 to 68 degrees F]) established for Washington and Oregon. Predators of juvenile salmonids include brown trout, walleye, smallmouth bass, and Northern pike. A voracious non-native top predator, the northern pike, may be increasing and should be monitored as it has been observed moving downstream from Montana. Bird predation on juveniles may also be increasing. Transformation of the mainstem Columbia and lower Snake Rivers into a series of reservoirs has altered food webs and predator prey interactions from historic conditions. Fish management and fish monitoring are also contributing factors to both indirect and direct impacts. Recreation and increased building of docks on the Columbia River allow for predator prey interactions that can impact juvenile salmonids. Flow objectives and water quality objectives are rarely met according to sub-basin plans, and spill can cause impacts directly to juvenile salmonids in the form of gas bubble disease.

These mainstem Columbia and lower Snake River areas are essential for maintaining bull trout distribution across Washington, Idaho, and Oregon, and conserving fluvial migratory life history forms exhibited by many adjacent core areas (USFWS 2010; Yoshinaka 2002a, 2002b). In the most southern area it provides key connectivity to maintain genetic contributions to the Lower Columbia and Snake River mainstem populations. These areas provide essential foraging, migration, and overwintering habitat for at least 16 core areas (*e.g.*, it provides the majority of forage, migration, and overwintering habitat for the Entiat core area). Bull trout are known to reside year-round in these mainstem reaches as sub-adults and adults, and spawning adults may use the mainstem up to 9 months of the year. Several studies indicate that bull trout migrations between the mainstem and core areas occur during periods of cooler water temperatures. There are several examples between the John Day and Yakima Rivers that suggest there is the potential for anadromous life history forms (E. Anderson, WDFW, pers. comm.

2015, and S. Deeds, USFWS, pers. comm. 2010). Our 2002 Draft Recovery Plan identified data gaps for bull trout use of the mainstem Columbia River but new information is limited.

Distribution and timing of use in the mainstem Columbia River has recently been reviewed by the Service's Columbia River Fisheries Program Office in Vancouver (Barrows *et al.* 2015) and additional studies by Anglin *et al*. (2012) and research by Yoshinaka (2002a) identified current and historical use of the mainstem. Barrows *et al.* (2015) located empirical evidence for at least 9 of 16 subbasins studied. They found generally that subadult bull trout migrate from their respective subbasins to the mainstem Columbia and Snake Rivers during the fall/winter (October to February) or during the spring/early summer (April to June). Migrations of adults were observed generally from October to February, but in the upper Columbia River geographic area bull trout are known to move out to mainstem FMO habitats in September (BioAnalysts 2004, Kelly Ringel *et al*. 2014, Nelson and Nelle 2008).

Barrow *et al.* (2015) also found that acoustic-tagged individuals in the mainstem Columbia River utilize deep, slow water habitat and suggest bull trout that overwinter within the mainstem may not establish a fixed winter range but instead continuously move throughout the corridor possibly using multiple habitat types. Individuals were described to be migrating through the mainstem corridor as far as 240 river km (150 river miles) downstream and 130 river km (80 river miles) upstream from the mouth of their natal subbasin though this varies by populations. Barrows *et al.* (2015) also indicated 93 percent of the mid-Columbia River and 100 percent of the lower Snake River in lineal distance are used by bull trout. Within the Upper Columbia geographic area, a small percentage of bull trout that were tracked using radio-telemetry were found to be long range movers and found to travel between the Methow River and down to the pool below Priest Rapids Dam, from the head of Nason Creek in the Wenatchee to the mouth of the Methow River, from the Entiat River into the Yakima River near the town of Yakima, and from the Chiwawa River in the Wenatchee basin into the Okanogan River (USFWS 2006, Nelson and Nelle 2008, Kelly Ringel *et al*. 2014, BioAnalysts 2004, PTAGIS 2015).

Interactions of bull trout at mainstem dams is better understood now than previously at the time of publication of our 2002 Draft Recovery Plan. Barrows *et al.* (2015) observed that migratory bull trout from 7 of the 16 subbasins (44 percent) that have local bull trout populations have had confirmed interactions with mainstem dams and that bull trout from all but one (86 percent) of these subbasins (Hood River) have interacted with more than one mainstem dam. Bull trout from two of the seven (29 percent) subbasins (Entiat River and Tucannon River) had interactions with five dams. Implications for legacy and ongoing impacts suggest further evaluation of effects is warranted. Maintaining connectivity and quality habitat in these mainstem river reaches will be important as temperatures and flow patterns change under future climate change scenarios.

Research Needs Areas

Northeastern Washington Research Needs Area

The Northeastern Washington Research Needs Area encompasses the mainstem Columbia River and its tributaries above Chief Joseph Dam upstream to the Canadian Border, Spokane River and tributaries upstream to Post Falls Dam, and the Pend Oreille River mainstem and its tributaries, in the United States, downstream of Boundary Dam. Previously this area was identified as the Eastern Washington Research Needs Area of the Northeast Washington Draft Recovery Unit.

Geographically, the area is located in the Okanogan Highlands and bound by the Kettle, Calispell, and Huckleberry Mountain Ranges. Ceded lands of the Colville and Spokane Tribes and National Forest overlap much of the area. Major tributaries include the Nespelem, Sanpoil, Spokane (up to Post Falls Dam), Kettle, Colville, and Pend Oreille Rivers. Approximately 90 percent of this Research Needs Area is in public or Tribal ownership managed by the U.S. Forest Service, Confederated Tribes of the Colville, and the Spokane Tribe of Indians. Lake Roosevelt is managed by the National Park Service. Lake Roosevelt and numerous other tributaries with sufficient water and temperatures to support bull trout are also present in the area, including Big Sheep, Wilmont, Barnaby, Deep, Sherman, Onion, Ninemile, Stranger, and Hall Creeks.

Operation of the Federal Columbia River Power System, which includes Chief Joseph and Grand Coulee Dams, altered habitat and populations. These dams impound the mainstem Columbia River as managed reservoirs: Lake Rufus Woods, the 82-km (51-mile) reservoir behind Chief Joseph Dam, and Lake Roosevelt, the 248-km (154-mile) long reservoir above Grand Coulee Dam. Some of the major impacts include: changed flow regimes, barriers to movement, and increased interactions with non-native species (Craig and Wissmar 1993; Rieman and McIntyre 1993). A significant loss of range in northeast Washington and Canada as well as connectivity between core areas throughout the Columbia River basin has occurred.

Based on interviews with Tribal elders, bull trout appear to have been ubiquitous throughout streams on the Colville Reservation (Hunner and Jones 1996). Accounts by Colville Tribal elders confirm historic presence of bull trout in several of the larger creeks, direct tributaries to Lake Roosevelt including: Ninemile Creek, Wilmont Creek, Twin Lakes/Stranger Creek, Hall Creek, and Barnaby Creek (Hunner and Jones 1996). Bull trout are thought to have been extirpated in several rivers of the Northeastern Washington Research Area, including the Nespelem, Sanpoil, and Kettle Rivers (USFWS 1998; Mongillo 1993). Bull trout are occasionally observed near the mouths of tributaries in Lake Roosevelt and in the upper mainstem Columbia River. Bull trout have not recently been observed in Lake Rufus Woods. Observation data is sporadic and often anecdotal. Since 2011, reports of bull trout observations in Lake Roosevelt have increased, often in association with high water years. In 2012, observations of 19 bull trout were reported throughout Lake Roosevelt by Tribal and educational survey crews, local citizens, and fishing charters. Most of these were assumed to be entrained fish from spawning areas in Canada and the Pend Oreille River. Six bull trout were observed in Sheep Creek that year (Honeycutt *in litt* 2014). Although suitable spawning habitat is located in several tributaries to Lake Roosevelt, no known spawning occurs in tributaries to Lake Roosevelt.

Given the historical use of the area and current infrequent observations of bull trout in the Northeastern Washington Research Needs Area, local area biologists determined more information is necessary to determine how these areas contribute to recovery needs or to further identify actions to address potential threats. With some areas of habitat capable of supporting bull trout in this Research Needs Area further evaluation is needed to determine extent of habitat and populations and the results will further recovery efforts.

Pacific Region
U.S. Fish & Wildlife Service
Ecological Services
911 N.E. 11th Avenue
Portland, OR 97232-4181

http://www.fws.gov

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