AQUATIC RESOURCES, HYDROLOGY, AND SOILS SPECIALIST REPORT (FINAL DRAFT)

Motorized Travel Management Project
Okanogan-Wenatchee National Forest

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Introduction

Regulatory Framework

Clean Water Act as amended in 1977, 1982 and 1987

The primary objective of the Clean Water Act is to restore and maintain the integrity of the nation's waters. This objective translates into two fundamental national goals: To eliminate the discharge of pollutants into the nation's waters, and to achieve water quality levels that are favorable for fishing and swimming in all water bodies.

The State of Washington, as directed by the Clean Water Act and the Environmental Protection Agency, is responsible for the protection of rivers and other water in the public interest. Water quality standards for surface waters in the State of Washington are found in Chapter 170-201A-WAC of the Washington Administrative Code.

The Forest Service responsibilities under the Clean Water Act are defined in a November 2000 Memorandum of Understanding (MOU) between Washington State Department of Ecology and the Forest Service. The MOU designates the Forest Service as the management agency for the State on National Forest System lands. This means that the Forest Service is responsible for defining and implementing appropriate Best Management Practices (BMPs) for National Forest System lands. The Motorized Travel Management Project (Project) Interdisciplinary Team (IDT) developed Mitigation Measures or Best Management Practices consistent with the MOU.

Water bodies that do not meet established water quality standards are identified on a list called the 303(d) list which is prepared periodically (most recently in 2014). Each state also prepares a non-degradation policy for all waters that exceed standards. This policy protects these waters from any further degradation. The Washington Department of Ecology has established a Total Maximum Daily Load (TMDL) for the Wenatchee National Forest to address streams on the 303(d) list (WDOE 2003). The primary objectives of the TMDL are to examine pollutant sources and determine the pollutant reductions (allocations) necessary to achieve the water quality standard. Refer to the Existing Condition section of this report for more information.

Special Status Fish And Species Of Conservation Concern

Of the 37 native fish species that occur on the OWNF, four species are listed as federally threatened or endangered species under the Endangered Species Act of 1973 as amended (ESA). Two additional species are protected under the Magnuson-Stevens Fishery Conservation Act (MSA). Three species are listed under the Regional Foresters Sensitive Species List (as updated on December 9, 2011), and six species on the Okanogan and six on the Wenatchee are designated as Management Indicator Species (MIS).

The Endangered Species Act of 1973 (as amended) (ESA)

The purpose of the ESA is to conserve threatened and endangered species and their ecosystems. Section 7 of the ESA outlines procedures for interagency cooperation to conserve Federally listed species and designated critical habitats. Section 7(a)(1) requires Federal agencies to use their authorities to further the conservation of listed species. Section 7(a)(2) requires Federal agencies to consult with the National

Marine Fisheries Service (NMFS) or U.S. Fish and Wildlife Service (USFWS), depending upon the species, to ensure that they are not undertaking, funding, permitting, or authorizing actions likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat.

Section 9 of the ESA prohibits the taking of endangered species of fish and wildlife. Take includes any activity that may harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct. Harm **i**ncludes the significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. If a federal agency's actions may result in take that is incidental to an otherwise lawful activity then the agency needs to receive an incidental take permit, issued by the USFWS or NMFS during the consultation process conducted under section 7(a)(2).

Finally critical habitat for listed species consists of: (1) the specific areas within the geographical area occupied by the species, at the time it is listed, on which are found those physical or biological features (constituent elements) (a) essential to the conservation of the species and (b) which may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species at the time it is listed upon a determination by the Secretary (of the Department of Interior or the Department of Commerce) that such areas are essential for the conservation of the species. Critical habitat is formally designated and published in the Federal Register. More information concerning these definitions may be found in the ESA or in USFWs and NMFS (1998)
.
The following species are listed under the ESA within the Project Area:

Endangered:

Upper Columbia River Spring Chinook (*Oncorhynchus tshawytscha*); listed as Endangered on March, 1999; Critical Habitat designated on September 2, 2005 (70 CFR 52630); Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan completed in August, 2007. On March 24, 1999, NMFS listed UCR Spring-run Chinook salmon as an endangered species (64 FR 14308) and their endangered status was reaffirmed on June 28, 2005 (70 FR 37160). This ESU includes all naturally spawned populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of Rock Island Dam and downstream of Chief Joseph Dam in Washington (excluding the Okanogan River), as well as six artificial propagation programs: the Twisp River, Chewuch River, Methow Composite, Winthrop National Fish Hatchery, Chiwawa River, and White River Spring-run Chinook hatchery programs. The Interior Columbia Basin Technical Recovery Team (ICBTRT) has identified three populations in one major population group (Eastern Cascades) for this species. A historic population in the Okanogan River has been extirpated (ICBTRT 2005).

Threatened:

Upper Columbia River Steelhead (*Oncorhynchus mykiss*); listed as Endangered on October 17, 1997, reinstated as endangered on June 13, 2007, reclassified as threatened on August, 2009; Critical Habitat designated on September 2, 2005 (70 CFR 52630); Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan completed in August, 2007. This Distinct

Population Segment (DPS)[1] includes all naturally spawned anadromous steelhead populations below natural and manmade impassable barriers in streams in the Columbia River Basin upstream from the Yakima River, Washington, to the U.S.-Canada border, as well six artificial propagation programs: the Wenatchee River, Wells Hatchery (in the Methow and Okanogan Rivers), Winthrop NFH, Omak Creek, and the Ringold steelhead hatchery programs. The ICBTRT (2007) has identified four populations within the project area: the Wenatchee River, Entiat River, Methow River, and Okanogan Basin.

Middle Columbia River Steelhead (*Oncorhynchus mykiss*); The Middle Columbia River (MCR) steelhead DPS was listed as threatened on March 25, 1999 (64 FR 14517) and their threatened status was reaffirmed on June 28, 2005 (70 FR 37160). Critical Habitat designated on September 2, 2005 (70 CFR 52630); Middle Columbia River Steelhead Recovery Plan completed in November, 2009. This DPS includes all naturally spawned populations of steelhead in streams from above the Wind River, Washington, and the Hood River, Oregon, upstream to, and including, the Yakima River, Washington, excluding steelhead from the Snake River Basin. Seven artificial propagation programs are considered part of the DPS: the Touchet River Endemic, Yakima River Kelt Reconditioning Program (in Satus Creek, Toppenish Creek, Naches River, and Upper Yakima River), Umatilla River, and the Deschutes River steelhead hatchery programs. The ICBTRT (2007) identified 20 populations in four major population groups (Eastern Cascades, John Day River, the Umatilla Rivers/Walla Walla, and the Yakima River).

Columbia River Bull Trout (*Salvelinus confluentus*); listed as Threatened on June 12, 1998, Critical Habitat designated on October 18, 2010 notice (50 CFR Part 17), a draft Bull Trout Recovery Plan was completed in April 2002, a Revised Draft Bull Trout Recovery Plan was released (USFWS 2014), and a Draft Mid-Columbia Recovery Unit Implementation Plan for Bull Trout Recovery was released in June 2015 (USFWS 2015).

The Forest has made a number of site-specific decisions on roads within the last 5 years, which have completed ESA section 7 consultation. Some of those consultations have either resulted in issuance of Biological Opinions (BO) or Letters of Concurrence for implementing site-specific travel management actions, which include road decommissioning, hydrologic closure and other road upgrading (improving aquatic ecological and water quality conditions at road-stream crossings, upgrading storm drainage, etc.). The Motorized Travel Management Project will not change past site-specific actions where Forest Service system and non-system roads have been decommissioned, hydrologically closed or upgraded as part of those past consultations.

Magnuson-Stevens Fishery Conservation and Management Act of 1976 as amended (MSA)

The Magnuson-Stevens Fishery Conservation and Management Act is the principal law governing marine fisheries in the United States. The MSA is primarily intended for the management of marine fisheries. The aspect of MSA relevant to this project is the identification of Essential Fish Habitat (EFH). EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of EFH: ‘‘Waters’’ include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; ‘‘substrate’’ includes sediment, hard bottom, structures underlying the waters, and associated biological communities; ‘‘necessary’’ means the habitat required to

[1] A distinct population segment is what constitutes a “species” under the ESA and is described as a group of organisms that is separated from other populations of the same taxon because of physical, physiological, ecological, or behavioral factors and that is significant to its taxon (NMFS 2006)

support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and ''spawning, breeding, feeding, or growth to maturity'' covers a species' full life cycle (67 FR 2343).

Federal agencies are required to consult with NMFS when any activity proposed to be permitted, funded, or undertaken by a federal agency may have adverse impacts on designated EFH. The project area includes designated EFH for Chinook salmon and coho salmon

Sensitive Species

Within the National Forest System, a sensitive species is a plant or animal whose population viability is identified as a concern by a Regional Forester because of a significant current or predicted downward trend in abundance or habitat quality that would reduce its distribution. The primary objective of the Sensitive species program is to ensure that federal actions do not contribute to a loss of viability, or cause a significant trend toward listing under the ESA. The following are Region 6 aquatic sensitive species that are suspected or known to occur on the OWNF;

- River Lamprey (*Lampetra ayresi*)
- Pygmy Whitefish (*Prosopium coulteri)*
- Umatilla Dace (*Rhinichthys umatilla)*

Management Indicator Species

36 CFR 219.19 (1982 planning rule) directs forests to establish objectives for maintenance and improvement of habitat for management indicator species (MIS). Management indicator species were designated in the Wenatchee National Forest Plan (1989) and the Okanogan National Forest Plan (1990). Species are selected as MIS because their population changes may indicate the effects of land management activities (36 CFR 219.19 (a) (1)).

Current MIS under Wenatchee Forest Plan:

- Cutthroat trout (*O. clarki)*
- Bull trout
- Steelhead
- Sockeye (*O.nerka)*
- Spring Chinook
- Summer Chinook

Current MIS under Okanogan Forest Plan:

- Cutthroat trout
- Redband/Rainbow trout (*O.mykiss)*
- Steelhead
- Spring Chinook
- Brook trout (*S. fontinalis*)
- Bull trout

Table 1-- Special Status Fish and Species of Conservation Concern in the project area by category

ESA	RF Sensitive	MIS	EFH
Upper Columbia spring Chinook (Endangered)	Umatilla Dace	Spring Chinook*	Chinook
Upper Columbia steelhead (Threatened)	Redband trout**	Summer Chinook~	Coho
Middle Columbia Steelhead (Threatened)	Pygmy whitefish	Sockeye~	
Columbia River Bull Trout (Threatened)	River Lamprey	Steelhead*	
		Bull trout*	
		Westslope cutthroat*	
		Redband ^,**	
		Brook trout**	

^ A sub-species of rainbow trout indigenous to the Columbia Basin (*O.m.gairdneri)*
***For Wenatchee and Okanogan portion of project area (*O.c. lewisi*)**
****For Okanogan portion of project area only**
~For Wenatchee portion of project area only

Land and Resource Management Plans (LRMP)

Currently, the Okanogan-Wenatchee National Forest is managed under two separate plans, the Okanogan Land and Resource Management Plan (LRMP), (USDA Forest Service 1989), and the Wenatchee LRMP (USDA Forest Service 1990). Regional and multi-Regional amendments subsequent to these two plans were made under the Northwest Forest Plan, PACFISH (Interim Strategies for Managing Anadromous Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho and Portions of California, USDA/USDI, 1995) and INFISH (Inland Native Fish Strategy, USDA, 1995). The Northwest Forest Plan for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl (NWFP) (USDA and USDI, 1994) contains an Aquatic Conservation Strategy and standards and guidelines that are incorporated into existing LRMPs when existing LRMP standards and guidelines are less restrictive than the NWFP. The Wenatchee LRMP is almost entirely within the NWFP analysis area (a very small amount of land is outside the NWFP and therefore technically within PACFISH); the Okanogan LRMP is partially within the NWFP, primarily from the Chewuch and Lower and Middle Methow Rivers westward. PACFISH amended the Okanogan LRMP for anadromous fish habitat outside of the NWFP area and INFISH amended the Okanogan LRMP outside of the areas not addressed by the NWFP and PACFISH. PACFISH applies from the NWFP area eastward to the Kettle Crest. INFISH applies east of the Kettle Crest. PACFISH and INFISH provide additional management direction related to anadromous and coldwater native fish, respectively, and establish Riparian Management Objectives (RMOs). The Riparian Reserve standards and guidelines in the NWFP are virtually identical to the Riparian Habitat Conservation Area (RHCA) standards and guidelines in PACFISH and INFISH.

Wenatchee National Forest Land and Resource Management Plan (Wenatchee LRMP) (USDA Forest Service 1990)

The Wenatchee LRMP goal for water resource management is to maintain favorable conditions of stream flow in regards to quality and quantity, and timing. The dominant objective is to insure meeting or exceeding federal and state water quality standards during the life of the plan (Wenatchee LRMP p. IV-57). For soil, the primary goal is to maintain or enhance the productive properties of the soil resource (Wenatchee LRMP p. IV-58). For fisheries, the primary fish habitat objectives are to maintain and improve fish habitat capability, integrate fish and riparian habitat management into other multiple use objectives, have an aggressive habitat management program, and develop management partnerships with local, state, federal, and tribal governments, and private groups (Wenatchee LRMP p. IV-41).

Riparian Areas, Streams, and Lakes

Wenatchee LRMP standards and guidelines for riparian areas, streams, and lakes are found in the forest plan on pages IV-84 to IV-88. They include direction on planning, administration, sediment, temperature, channel morphology, floodplain/riparian vegetation, fish passage, lakes and wetlands, and non-fish bearning streams. Refer to that document for details. These standards and guidelines were strengthened and augmented by the Northwest Forest Plan and PACFISH.

Wildlife and Fish Surveys and Plans

- Wildlife and fish resources on the Wenatchee in particular the habitat of indicator species, shall be managed in cooperation with fish and wildlife agencies. Project assessments and habitat improvement projects should be reviewed with appropriate agencies. (WNF LRMP, IV-80)
- Fish and wildlife habitat shall be managed to maintain viable populations of all existing native and desired non-native vertebrate species in approximately their present distribution.
  - A. Maintain or enhance limited habitats to provide the habitat characteristics for dependent species. These habitats include, but are not limited to, cliffs, caves, talus, ponds, marches, wetlands, and areas of colony nesting species. Activities that need to be sensitive to limited habitat needs are logging, roads, trails, campgrounds, facilities, etc. (WNF LRMP IV-80,81)Follow the specified measurable standards for fine sediment in spawning gravels, water temperature, channel morphology (large wood and pools), floodplain/riparian vegetation and fish passage (Wenatchee LRMP: IV-80 to IV-88).

Water

1. Protection of Water Quality – Comply with State requirements for protection of waters of the State of Washington (Washington Administrative code, Chapters 173-201 and 202) through planning, application, and monitoring of Best Management Practices (BMPs) in conformance with the Clean Water Act, regulations, and federal guidance issued thereto. (WNF LRMP IV-94)

Soil

7. Surface water will be controlled on all roads, landings, rock pits, parking areas, and other road related facilities. (WNF LRMP IV-97)

Okanogan National Forest Land and Resource Management Plan (Okanogan LRMP)(USDA Forest Service, 1989)

Objectives for the watershed program include coordinating with other resources to provide support and advice that helps protect soil and water resource, as well as restoring damaged soil and water resources (Okanogan LRMP p. 4-19). The goal for fish habitat is management that maintains or enhances biological, chemical, and physical properties, and to be responsive when possible to the goals of other agencies and tribes (Okanogan LRMP p. 4-2). Further, an emphasis is placed on coordination with other resource activities to improve or maintain habitat for fish. This coordination is primarily accomplished by proper implementation of standards and guides (Okanogan LRMP p. 4-25 to 4-32).

Okanogan LRMP standards and guidelines that apply to riparian areas and streams are located on pages 4-30 to 4-32. As with the Wenatchee LRMP, these were strengthened and augmented by the Norwest Forest Plan, PACFISH, and INFISH.

Northwest Forest Plan (NWFP)

The NWFP for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl (USDA and USDI 1994) developed standards and guidelines which amended National Forest Plans in the analysis area. Specifically, the NWFP amended some of the standards and guidelines of approved National Forest Land and Resource Management Plans, including all of the Wenatchee National Forest Land and Resource Management Plan, and portions of the Okanogan National Forest LRMP.

The NWFP includes The Aquatic Conservation Strategy (ACS) that was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems on National Forestlands. The ACS includes nine objectives to guide management for healthy watershed and aquatic resources. Management actions that do not maintain the existing condition or do not lead to improved conditions in the long term would not “meet” the intent of the ACS should not be implemented. The Aquatic Conservation strategy consists of four components: Riparian Reserves (RR), Key Watersheds, Watershed Analysis, and Watershed Restoration. Standards and guidelines for management with RR and Key Watersheds provide further management direction.

Table 2 Aquatic Conservation Strategy Objectives

Aquatic Conservation Strategy Objectives
Objective 1: Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.
Objective 2: Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.
Objective 3: Maintain and restore the physical integrity of the aquatic system including shorelines, banks, and bottom configurations.
Objective 4: Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.
Objective 5: Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.
Objective 6: Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.
Objective 7: Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.
Objective 8: Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.
Objective 9: Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.

The ACS standards and guidelines especially relevant to this project are (see USDA and USDI 1994 for details):

RF-2 (a-g) Requires that roads be minimized in Riparian Reserves and avoid wetlands and disruption of hydrologic flow paths, and have operation and maintenance criteria (relevant for unauthorized routes that are adopted as system roads). For each existing or planned road, meet Aquatic Conservation Strategy objectives by: a) minimizing road and landing locations in Riparian Reserves; b) completing watershed analyses (including appropriate geotechnical analyses prior to construction of new roads or landings in Riparian Reserves; c) preparing road design criteria, elements, and standards that govern construction and reconstruction; d) preparing operation and maintenance criteria that govern road operation, maintenance, and management; e) minimizing disruption of natural hydrologic flow paths, including diversion of streamflow and interception of surface and subsurface flow; f) restricting sidecasting as necessary to prevent the introduction of sediment to streams and; g) avoiding wetlands entirely when constructing new roads.

RF-3 Requires that roads be closed or obliterated and stabilized based on effects to ACS objectives. Determine the influence of each road on the Aquatic Conservation Strategy objective through watershed analysis. Meet Aquatic Conservation Strategy objectives by: a) reconstructing roads and associated drainage features that pose a substantial risk; b)prioritizing reconstruction based on current and potential impact to riparian resources and the ecological value of the riparian resources affected and; c) closing and stabilizing, or obliterating and stabilizing roads based on the ongoing and potential effects to Aquatic Conservation Strategy objectives and considering short-term and long-term transportation needs.

RM-1 Requires that new trails be designed to not prevent meeting or prevent future attainment of Aquatic Conservation Strategy objectives. Existing recreation facilities within Riparian Reserves, must not prevent, and to the extent practicable contribute to, attainment of Aquatic Conservation Strategy objectives.

RM-2 Requires that dispersed and developed recreation practices that retard or prevent attainment of Aquatic Conservation Strategy objectives be adjusted and where adjustment measures are not effective, the practice or occupancy be eliminated.

INFISH and PACFISH

Both PACFISH (USDA Forest Service and USDI Bureau of Land Management 1995) and INFISH (USDA Forest Service 1995) establish stream, wetland, and landslide-prone area protection zones called riparian habitat conservation areas (RHCAs), and set standards and guidelines for managing activities that potentially affect riparian and aquatic habitat conditions within RHCAs. The standards and guidelines include managing vehicles and motor vehicle use in a manner that does not retard or prevent attainment of riparian management objectives (RMOs) and avoids adverse effects on listed anadromous fish (PACFISH) or inland native fish (INFISH). The RMOs identify interim objectives for stream channel conditions such as pool frequency, water temperature, large woody debris and bank stability. The RMOs are considered to be interim and Forests can revise them based upon local data.

The RHCA standards and guidelines are essentially the same as those for the NWFP, except, rather than requiring attainment or prohibiting practices that prevent attainment of the ACS, the standards and guidelines in PACFISH and INFISH require attainment or prohibit practices that prevent attainment of RMOs.

Much like the ACS of the NWFP, PACFISH and INFISH include goals for the maintenance and restoration of riparian areas:

1. Water quality to a degree that provides for stable and productive riparian and aquatic ecosystems;
2. Stream channel integrity, channel processes, and the sediment regime (including the elements of timing, volume, and character of sediment input and transport) under which the riparian and aquatic ecosystems developed;
3. Instream flows to support healthy riparian and aquatic habitats, the stability and effective function of stream channels, and the ability to route flood discharges;
4. Natural timing and variability of the water table elevation in meadows and wetlands;
5. Diversity and productivity of native and desired non-native plant communities in riparian zones;
6. Riparian vegetation to:
    1. Provide an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems;

2. Provide adequate summer and winter thermal regulation within the riparian and aquatic zones; and
3. Help achieve rates of surface erosion, bank erosion, and channel migration characteristic of those under which the communities developed.

7. Riparian and aquatic habitats necessary to foster the unique genetic fish stocks that evolved within the specific geo-climatic region; and
8. Habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities.

Best Available Science and Rationale

Physical Interactions of Roads and Trails, Cross Country Motorized Travel, and Motorized access for Dispersed Camping

Road and Trail Network

Roads and trails can cause erosion, alter water movement on the landscape, and change how streams function when they cross or confine the stream. Erosion is the wearing away of the soil surface by water, wind, ice, or gravity when energy from these agents is sufficient to detach and transport soil particles. Human activities can accelerate erosion and alter sediment delivery. Road prisms and trails lack vegetative cover, can have decreased permeability due to compaction, displacement and puddling. These conditions can result in concentrating runoff and increasing energy available to displace and transport sediment to stream channels through road drainage system and from the road prism.

The specific location of routes on the landscape is one of the factors affecting sediment delivery to aquatic systems. Roads built decades ago are often located in valley bottoms next to streams and are difficult to relocate (Swift and Burns 1999). Roads next to streams can prevent natural channel migration, restrict the stream's ability to access the floodplain, and alter how sediment is both transported and stored in the streambed (Gresswell 1999, Gucinski et al. 2001, Trombulak and Frissell 2000). Roads and trails that cross streams offer direct pathways for eroded sediment to be delivered to drainage networks.

Trails, and particularly Off-Highway Vehicle (OHV) trails, share many of the road attributes, such as decreased vegetative cover, increased compaction, increased runoff, and are also a source of chronic and long-term accelerated sediment delivery to streams. Extensive networks of OHV routes across a landscape, especially on steep slopes can direct or alter the direction of surface flow forming gullies that channel sediment and contaminants into aquatic systems (Ouren *et al*. 2007).

Road and trail drainage features along hillslopes may become rilled and gullied, allowing for efficient delivery of sediment to streams. Field surveys and analysis of a road system in the western Cascades of Oregon found that the road network increased drainage density by 21 to 50 percent depending on which road segment was assumed to be connected to streams (Wemple et al. 1996). OHV impacts in mid-latitude forest environments include surface compaction and accelerated erosion (Sack 2003). Horse and OHV trails have been found to be more degraded than hiking and biking trails, while a larger proportion of OHV trails exhibited severe erosion when compared to horse, hiking and bike trails (USDI 2006). At the watershed scale, the number of road and trail stream crossings[2] is a measure of the potential of a route to transport sediment from the route prism to the stream network. The greater the number of stream crossings within a watershed, the more likely it is that sediment will be delivered to the stream network. In addition to sediment, roads can deliver pollutants to stream systems and aquatic habitat as the chemicals applied to roads for dust abatement or from vehicles runs off a road into a stream (Gucinski *et al* 2001). Road crossings, by virtue of their size and use can potentially deliver more sediment than motorized trail crossings, which in turn can be expected to produce and deliver more sediment than non-motorized trail crossings.

Road and trail use can produce fine, easily detached and eroded soil particles, especially if use exceeds the original design of the road (Swift and Burns 1999). Roads are a major source of accelerated erosion (Grace and Clinton 2007) and provide a potential delivery mechanism of fine sediment to streams. Higher levels of use coincide with higher sediment production rates when compared to light levels of use (Reid and Dunne 1984), where high use refers to multiple loaded log trucks per day and light use refers to no logging trucks but some light vehicles. Roads contribute higher amounts of sediment to streams than any other single human-induced action on National Forest System (NFS) lands (Gresswell 1999).

Roads and trails also can affect hydrologic function in addition to increasing sediment delivery to streams. As mentioned earlier, road networks have the potential to increase the drainage network of a watershed, which can alter flow routing efficiency and change the overall timing of the hydrograph (Wemple et al. 1996, Bowling and Lettenmaier 2002). Increases in peak flows can result in changes to stream channels and their ability to manage sediment. Efficiently routing water through a system through interception and increased surface runoff may also result in less water available late season for low flows. Low flows are more susceptible to temperature increase, which in turn can affect aquatic species. As well as being used as a measure of the potential for sediment production, open route density, miles of routes in Riparian Reserves and RHCAs, and the number of stream crossings are all useful indicators of the potential for the transportation system to affect hydrologic function. As these indicators decrease the potential to influence the effects listed above decreases. The effects of roads can be reduced but not eliminated by careful consideration of the location, design, and employing design or maintenance methods to disperse runoff (Furniss *et.al* 1990).

Natural rates of sediment production and delivery are essential to the functioning of the stream channel. Both natural and human-caused disturbances can and do alter sediment delivery, but they do so in different ways. Natural events deliver sediment in discrete pulses that structure and maintain the aquatic ecosystem (Reeves et al. 1995; Yount and Niemi 1990). Pulse events are intense and short term. Sediment delivered by roads is an example of a press event (Reeves et al. 1995; Lake 2003). Press events are chronic conditions that interrupt ecological processes, can cover a large area, and the effects can reach a constant level that is maintained. Press events are often referred to as chronic conditions. Extensive road systems interrupt stream networks and chronically deliver fine sediment.

Interim RRs and RHCAs range from approximately 100-300 feet depending on the type of water body or feature they contain. Vegetation strips maintained between travel routes and streams can minimize the effect of travel routes on stream environments. A review of the effects of buffer strips in reducing impacts from forest practices suggest vegetated buffer strips on the order of 200-300 feet are generally effective at controlling non-channelized sediment (Belt et al. 1992). A more recent literature review, while acknowledging uncertainty and variability in site specific conditions, concludes that buffers of ≥30

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[2] In this context, and throughout the document, stream crossings refer to sites where a road, or trail, crosses the path of a stream. The crossing may be accomplished by a bridge, a culvert, or a drivable ford. It is the proximity of the road prism, with easily erodible sediment, to the stream channel which increases the likelihood of sediment delivery. Sediment delivery is not necessarily dependent on the type of crossing.

m (100 feet) wide are needed to protect water quality, habitat, and biotic features of streams in 5th level HUs (Sweeney and Newbold 2014). Both of these studies indicate forest vegetation can intercept sediment delivered by sheet erosion or overland flow. Should flows become concentrated in rills or develop gullies, buffer strips will not intercept sediment being carried by these features because rills and gullies are un-vegetated.

The miles of designated open roads and trails in RRs or RHCAs are indicators of the potential of the transportation system to deliver sediment to the stream network, with potential increasing proportional to miles. Currently there are 1313 miles of road in RRs /RHCAs, 828 miles of these roads are designated open National Forest System roads (maintenance level 2-5). The remainder are designated closed, Non-FS jurisdiction or unauthorized (see Table 20). There are 182.9 miles of Forest Service system trails open to motorized vehicles within the Riparian Reserve/RHCAs at the present time (see Table 16). Similarly, the acreage of Riparian Reserve/RHCAs within a watershed open to cross country travel (by virtue of the Forest being open to cross country travel unless specifically closed) is a useful measure of the potential of dispersed motorized use to deliver sediment to the stream network.

Biologic Interactions of Roads and Trails, Motorized Cross Country Travel, and Dispersed Recreation Sites

The greater the acreage of RRs/RHCAs open to cross country travel, the greater the potential for sediment delivery to streams networks. There are approximately 275,416 acres of Riparian Reserves/RHCAs within the portion of the forest currently open to cross country motorized travel. Unmanaged vehicle use within RRs and RHCAs can alter water quality and stream function. Riparian areas include streams, lakes, floodplains, wetlands, swamps, bogs, marshes, seeps, and all adjacent riparian vegetation. Motor vehicle cross-country travel can damage lands within RR/RHCAs directly from surface traffic and indirectly by hydrologic modifications, soil transport and deposition, and vegetation alteration. Hydraulic modifications include disruption of surface water flow, reductions in filtration and percolation, surface ponding, and the loss of water holding capacity (Meyer 2002). Other indirect impacts include those associated with erosion and the deposition of transported particles. Water quality can be degraded by erosion through sediment delivered directly to streams from cross-country motor vehicle travel and roads used by motor vehicles. Vegetation can be altered by compaction or cutting to clear routes.

The potential effects of roads and trails in RR/RHCAs may be exacerbated when the travel ways lead to dispersed camping adjacent to streams. Disturbance in aquatic systems is a particular problem for anadromous fish holding and spawning, reducing spawning success (Moyle et al. 1996). Dispersed camping may lead to additional vegetation loss that expose soils to erosion, removes stream shade, increases soil compaction, damages stream banks, and increases bank erosion through trampling. These changes result in decreases to water quality that can result in negative impacts to aquatic resources such as fish and aquatic invertebrates. Dispersed camping may also encourage harassment of spawning fish, especially bull trout and salmon that spawn in the late summer and fall. Redds may be damaged resulting in egg and alevin mortality if disturbed by campers.

Aquatic resources and water quality are dependent on the protection of naturally occurring processes. Processes include natural sediment delivery, natural flow regimes, trees and vegetation along water bodies that provide shade and moderate temperature, and provide habitat for terrestrial insects that are an important food source for native salmonids, as well as supply vegetative material that is a food source for aquatic insects. Stream adjacent vegetation helps filter sediment before it enters the aquatic environment and helps stabilize stream banks preventing accelerated levels of bank erosion. Downed trees interact with the stream and shape aquatic habitat by creating pools and providing cover. The designation of RRs and RHCAs are intended to protect these processes. The RRs/RHCAs include traditional riparian corridors, wetlands, intermittent headwater streams, and other areas where proper ecological function is crucial to maintenance of water, sediment, woody debris, and nutrient delivery systems in streams (USDA 1994, USDA and USDI 1995).

Elevated fine sediment delivery to streams can detrimentally alter aquatic stream habitat on which organisms are dependent. Sediment may harm salmon and trout by filling interstitial spaces in coarse substrates where adults spawn, alevin (newly hatched fish still attached to their yolk sac) absorb their yolk sac, and juveniles hide (Wood and Armitage, 1997; Greig et al. 2005). Excessive levels of fine sediment prevents oxygen from getting to eggs and alevins. Elevated fine sediment can also reduce microorganism primary production, aquatic insect diversity and productivity, and overall biomass and organic content in streams (Wood and Armitage 1997). Finally, fine sediment can effect respiration and feeding success for both juvenile and adult salmonids (Wood and Armitage 1997, Shaw and Richardson 2001). Respiration is affected by gill filament and raker irritation and clogging. Swimming activity can be reduced, and subsequently health can deteriorate (Wood and Armitage 1997). Feeding can be affected by reduced prey availability, reduced foraging success caused by reduced water clarity, and prolonged suspended sediment periods that cause fish to avoid feeding (Wood and Armitage 1997; Shaw and Richardson 2001).

Water temperature is an important variable affecting salmonids (McCullough, 1999). Temperature influences timing of migration and spawning, egg maturation, growth, incubation success, intra- and inter-specific competitive ability, and a resistance to parasites, diseases, and pollutants (Bjornn and Reiser 1991, Reeves et al. 1987, Greig et al. 2005). Increased temperatures have been related to reductions in salmonid abundance or changes in their spatial distribution (Platts and Nelson 1988). Tolerances vary by life stage and species. For example, bull trout require colder water for spawning and rearing than other salmonids (USFWS 2014), while rainbow and redband trout are generally more tolerant of higher water temperatures than other native salmonids (Bjornn and Reiser 1991). The effects of elevated stream temperatures not only vary by species but also life stage. Sustained temperatures above 73 to 79 degrees Fahrenheit are lethal for salmonids. Optimal growth occurs from 50 to 61 degrees Fahrenheit (Meehan and Bjornn 1991). The duration of temperature elevation and the pre-elevation acclimating temperature are important factors that affect salmonid metabolic response to increased water temperatures.

Increased water temperatures due to management or combined with the warming trends associated with climate change can decrease the amount of suitable habitat for a species and increase competition with non-native species. Increased stream temperatures may put bull trout in a competitive disadvantage with brook trout where the two species overlap (Rodtka and Volpe 2007, McHahon *et al.* 2007), and the potential for native westslope cutthroat trout to hybridize with non-native rainbow trout is greater in streams with higher mean summer water temperatures (Muhlfield *et al*. 2009).

Human uses adjacent to streams whether roads, trails or motorized access for dispersed camping can damage stream bank vegetation. Loss of streambank vegetation can result in stream channel widening and a reduction of large woody debris available for recruitment to the stream. Wider streams with shallow flow are subject to greater amounts of warming. Maintenance of streambank integrity and shade along streams is essential to the maintenance of optimum water temperature and aquatic habitat for naturally occurring biota.

Roads and to possibly a lesser extent trails interrupt the delivery of wood into stream channels. Meredith *et al.* (2012) found that within the interior Columbia Basin, the presence of near-stream roads resulted in reduced amounts of woody debris in streams. In addition to the physical effects the transportation may have on stream channels and aquatic habitat, improperly constructed road and trail crossings create passage barriers that may prevent upstream passage of adult fish into spawning areas or passage of juvenile and resident fish into suitable habitat at different times of the year.

The transportation system is also an indicator of the level of potential human use that may affect aquatic habitat within a watershed. Lee *et al.* (1997) found strong fish populations in the interior Columbia basin were more frequently found in areas of low road density, and thus lower potential human use. Similarly, AL-Chokhachy *et al.* (2010) found reference watersheds generally have higher quality stream habitat than more heavily managed watersheds.

Critical Fish Habitat (CFH)

While the potential effects of roads, cross-country motorized vehicle travel and dispersed camping are of concern for all aquatic habitat, the concerns are heightened where the activities may impact designated critical habitat. CFH has been designated for Upper Columbia spring Chinook salmon, Mid-Columbia spring Chinook salmon, Upper and Mid-Columbia steelhead and bull trout. Critical habitat for these species consists of: (1) the specific areas within the geographical area occupied by the species, at the time it is listed, on which are found those physical or biological features (constituent elements) (a) essential to the conservation of the species and (b) which may require special management considerations or protection. The constituent elements, or primary constituent elements (PCEs) for bull trout (FR 75 63931, 63932) that may be affected by motorized recreation and dispersed camping decisions ~~pertinent~~ particularly pertinent to the Travel Management Project are:

1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality, and quantity and provide thermal refugia.
2. Migration habitats with minimal physical, biological or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.
3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
4. Complex river, stream, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channel, pools, undercut banks and unembedded substrate, to provide a variety of depth, gradients, velocities, and structure.
5. Water temperatures ranging from 36°f to 59°F, with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.
6. In spawning and rearing areas, substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.
7. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

The PCEs for the listed Chinook salmon and steelhead species that may be affected by the Travel Management project are displayed in Table 3.

Table 3 PCEs for Upper and Mid-Columbia Steelhead and Upper Columbia Chinook Salmon Pertinent to the Travel Management Project and Life Stage Each PCE Supports (50 CFR Part 226)

	Primary Constituent Element	Life Stage Supported
Freshwater Spawning	Water quality Water quantity Substrate	Spawning Incubation Larval development
Freshwater Rearing	Water quantity Floodplain connectivity	Juvenile growth and mobility
	Water quality Forage	Juvenile development
	Natural cover	Juvenile mobility and survival
Freshwater Migration	Free of artificial obstructions Water quality and quantity Natural cover	Adult mobility and survival Juvenile mobility and survival

Removing vegetation that shades streams and wetlands can contribute to increased stream temperatures and impair fish habitat when high temperatures are a limiting factor. By removing vegetation, roads and dispersed camping in RR/RHCAs can reduce stream shade and create warmer micro-climates, which in turn can incrementally elevate stream temperatures and thus may degrade water quality, floodplain connectivity, the food base and in-channel habitat components of the above PCEs Road miles and acres within RHCAS open to cross country travel and of corridors used for dispersed camping both in RR/RHCAs and adjacent to Critical Habitat can be useful indicators of the effects of roads and dispersed camping on aquatic habitat.

Methods

Method of measure by action
This section describes the actions, time frame of analysis, spatial boundary being used, indicators analyzed, methodology, and rationale.

Key Issue #5, and Other Issue #3 (refer to Issues in Chapter 1) relate to fish, water and aquatic resources. These, along with concerns about meeting Clean Water Act requirements relating to non-point source pollution and Amended Forest Plan requirements for fish, water and aquatic resources, were used to develop the analysis boundaries in space and time, indicators for analysis, analysis methodology, and rationale, as described below:

Direct and indirect effects of the prohibition of cross-country motor vehicle travel.

Short-term timeframe: 1 year.
Long-term timeframe: 20 years.
Spatial boundary: Forest boundary.
Rationale for boundary: Project only applies to Forest Service ownership.
Indicator(s):

- Change in acres of area open to cross-country motor vehicle travel.
- Change in acres of 5th level HU in Riparian Reserves or RHCAs open to cross-country motor vehicle travel.

Methodology: GIS analysis of acres open to cross country travel, site visits to areas where cross country travel is currently occurring, and literature review and analysis.
Rationale for indicator: Literature indicates that placement of routes in relation to habitat can affect aquatic species through mortality, disturbance, and habitat modification (Moyle and Randall 1996, Trombulek and Frissell 2000, USDA Forest Service 2000).

Direct and indirect effects of designating corridors for motorized access to dispersed camping.

Short-term timeframe: 1 year.
Long-term timeframe: 20 years.
Spatial boundary: Portions of the Hydrologic Unit (HU) within the Forest boundary. For some indicators the spatial boundary was extended to the watershed boundary regardless of the land ownership in order to evaluate conditions in a manner that better and more clearly discloses effects.
Rationale for boundary: Direct effects are physically limited to location of actions within Forest Service ownership. Indirect effects may be propagated throughout the watershed. Analysis is at the watershed level (5^{th} level Hydrologic Unit, HU) to maintain consistency with the ACS and because the subbasin scale 4^{th} level HU) is too large to identify potential effects.
Indicator(s):

- Acres of 5^{th} level HU in Riparian Reserves or RHCAs designated as *Corridors*.
- Acres of 5^{th} level HU within 300 feet of Critical Habitat designated as *Corridors*.

Methodology: GIS analysis of added routes in relation to riparian habitat and important/sensitive aquatic areas. Site visits, 2010 sample inventory of unauthorized routes and access points for access to dispersed recreation sites, and literature reviews.
Rationale: Literature indicates that placement of routes in relation to habitat can affect aquatic species through mortality, disturbance, and habitat modification (Moyle and Randall 1996, Trombulek and Frissell 2000, USDA Forest Service 2000)

Existing Condition

Analysis Area & Boundary Rationale

The area of direct effects analysis is located within the Okanogan-Wenatchee National Forest boundary. Direct, indirect and cumulative effects are analyzed at the watershed scale (5^{th} level hydrologic unit, HUC 5).

The analysis area includes the following 53 watersheds that occur within the project boundary (5^{th} level Hydrologic Units):

Table 4--Watersheds (5^{th} level Hydrologic Unit) within the Project Boundary

HU code and Watershed Name	Total Acres	FS OkaWen Acres	Percent FS OkaWen
1702000209 Myers Creek	81083.9	23497.4	29.0
1702000211 Rock Creek-Kettle River	152800.8	369.9	0.2
1702000212 Toroda Creek	104124.2	44023.4	42.3

1702000401 Upper Sanpoil River	181183.2	18473.8	10.2
1702000402 West Fork Sanpoil River	198986.5	68184.4	34.3
1702000505 Swamp Creek-Columbia River	172832.8	17365.2	10.0
1702000615 Inkaneep Creek-Okanogan River	165508.6	12801.8	7.7
1702000616 Antoine Creek-Okanogan River	117988.0	16414.5	13.9
1702000617 Bonaparte Creek	91715.3	29593.8	32.3
1702000618 Tunk Creek-Okanogan River	158309.8	14058.7	8.9
1702000620 Salmon Creek	96485.2	59077.2	61.2
1702000621 Scotch Creek-Okanogan River	148831.0	3178.7	2.1
1702000622 Loup Loup Creek-Okanogan River	196027.2	3435.4	1.8
1702000701 Pasayten River	150487.5	104954.7	69.7
1702000702 Castle Creek-Similkameen River	121677.5	29307.2	24.1
1702000713 Headwaters Ashnola River	116319.7	35446.7	30.5
1702000714 Ewart Creek	62142.8	7702.0	12.4
1702000718 Toats Coulee Creek	85997.8	33184.1	38.6
1702000719 Sinlahekin Creek	92836.2	801.0	0.9
1702000801 Lost River	106995.9	106926.2	99.9
1702000802 Upper Methow River	120977.0	119039.9	98.4
1702000803 Upper Chewuch River	145001.1	145001.7	100.0
1702000804 Lower Chewuch River	191387.1	171000.2	89.3
1702000805 Twisp River	157207.6	145604.1	92.6
1702000806 Middle Methow River	248594.4	164276.8	66.1
1702000807 Lower Methow River	193911.4	128991.7	66.5
1702000901 Stehekin River	218736.0	100514.9	46.0
1702000902 Upper Lake Chelan	233587.9	211713.9	90.6
1702000903 Lower Lake Chelan	144467.7	82664.0	57.2
1702001001 Mad River	58454.6	54266.2	92.8
1702001002 Entiat River	209167.2	177748.0	85.0
1702001003 Lake Entiat-Columbia River	314380.9	38893.3	12.4
1702001004 Lynch Coulee-Columbia River	212143.7	6.3	0.0
1702001101 White River-Little Wenatchee River	175255.2	168406.2	96.1
1702001102 Nason Creek	69649.8	55553.8	79.8
1702001103 Chiwawa River	120677.2	116568.8	96.6
1702001104 Icicle Creek	137156.0	131109.6	95.6
1702001105 Peshastin Creek	86745.0	64472.6	74.3
1702001106 Mission Creek	59335.7	36635.0	61.7
1702001107 Wenatchee River	201444.4	119489.6	59.3
1703000101 Cle Elum River	141651.4	125114.5	88.3
1703000102 Middle ForkTenaway River-Tenaway River	132119.6	67498.1	51.1
1703000103 Kachess River-Yakima River	199762.4	105805.6	53.0
1703000104 Wilson Creek-Cherry Creek	252704.6	19614.9	7.8

1703000105 Taneum Creek-Yakima River	291468.4	93345.4	32.0
1703000106 Wenas River	122789.7	8322.3	6.8
1703000201 Little Naches River	219885.8	213623.0	97.2
1703000202 Rattlesnake Creek-Naches River	192156.5	142327.5	74.1
1703000203 Tieton River-Naches River	294910.6	162315.6	55.0
1703000301 Ahtanum Creek	109258.7	657.3	0.6
1711000504 Three Fools Creek-Lightning Creek	86266.6	64058.0	74.3
1711000505 Ruby Creek	138681.3	108540.4	78.3
1711000506 Ross Lake-Skagit River	175006.2	25275.9	14.4

The Okanogan- Wenatchee National Forest shows considerable diversity from north to south and from the Cascade Crest eastward. Elevations range from over 8000 feet at the crest to below 1000 feet along the Columbia River.

Similarly, precipitation varies greatly over the Forest. Gradients along the Cascade Crest of the Forest are typical of a maritime climate regime with a large rain shadow provide by the Cascade Range. Precipitation ranges from over 120 inches per year at the crest to below 10 inches along the Columbia River. On the northeastern portion of the Forest, the climate transitions into one more typical of a continental climate regime with precipitation around 10 inches per year along the Okanogan River, and about 20 inches per year in the Okanogan highlands east of the Okanogan River.

Not only does the climate vary from north to south, so does the underlying geology. The northeast portion of the Forest is located on the Okanogan Highlands, the central and northern portions of the forest are in the North Cascades geologic province, while the very southern part of the Forest is located in the Southern Cascades province.

The climatic, topographic and geologic variability give rise to a general pattern of soil development across the Forest. Soils on the Okanogan Highlands portion of the Forest are predominately silt loams, with relatively high soil erodibility factors. Soils on the northeastern portion of the Methow Valley Ranger District are predominately loams with a moderate erodibility factor, while down valley and lower elevations are silt loams and fine sandy loams, again with high erodibility factors. Soils in the North Cascades Province to essentially the 1-90 corridor are sandy loams and fine sandy loams with moderate erodibility factors. Exceptions occur in the eastern end of the Wenatchee River Ranger District where silt loams have a high erodibility factor and the eastern edge of the Cle Elum Ranger District where sandy loam soils have high erodibility factors. Soils in the Southern Cascade Province on the Naches Ranger District are predominately loams that have high erodibility factors. (USDA-NRCS, 2013).

Aquatic and riparian habitats on the OWNF are extensive, with approximately 11,800 miles of streams and rivers (5, 000 miles of perennial streams and 6,800 miles of intermittent streams) on the Forest, of which approximately 1,600 miles are fish-bearing. RRs and RHCAs cover approximately 520,000 acres (approximately 13% of the forest). There are over 1,000 lakes ranging from very large lakes (e.g., Lake Wenatchee and Lake Chelan) to numerous small high mountain lakes. The Forest contains over 750 perennial snowfields and small glaciers, most of which lie within the north half of the Forest. The majority of streams and rivers on the Forest drain into the Columbia River Basin. Major sub-basins (4th level hydrologic units) include; the Kettle, Sanpoil, Okanogan, Methow, Chelan, Entiat, Wenatchee, Naches, and Upper Yakima. In addition to these sub-basins, the Okanogan-Wenatchee manages several watersheds that are within the administrative boundary of the Mt. Baker-Snoqualmie NF but adjacent to the upper Methow River. Streams and rivers within these watersheds drain into the upper Skagit River in Whatcom County and eventually into the Puget Sound. The streams that drain into Puget Sound will not be discussed further as there are no roads or motorized trails and thus will not be affected by the Travel Management Project.

Soil Conditions

Detrimental soil disturbance is the alteration of natural soil characteristics that result in immediate or prolonged loss of soil productivity and soil-hydrologic conditions. The Wenatchee National Forest Land and Resource Management Plan defines detrimental disturbance as compaction, displacement, puddling or severely burned soils on more than 20 percent of an activity area (IV-97). Wildfires have burned on the Chelan, Entiat, Wenatchee River, Cle Elum, and Naches Ranger District over the past 10 years. The mosaic burn patterns in these fires left some soils severely burned, but covering less than 20% of the National Forest System land. The Okanogan National Forest Land and Resource Management Plan uses 15 percent of an activity area (4-46) although this does not include roads or landings. Both plans relate soil productivity standards to these definitions of detrimental disturbance. These definitions are related to management activities such as timber harvest and are not necessarily applicable in the context of travel management. However it is clear that currently existing roads, trails, and unauthorized roads and trails exhibit detrimental disturbance and have little soil productivity.

Water Quality (temperature, contaminants, and Dissolved Oxygen)

303(d) streams

Within the Motorized Travel Management Project planning area, several streams appear on the most recent Clean Water Act 303(d) list. Impaired streams are grouped by Ranger District, which mostly correlate with sub-basins. Sub-basins are collections of watersheds that drain through a single outlet; sub-basins in the project area include the Naches, Upper Yakima, Wenatchee, Entiat, Chelan, Methow, Okanogan, Kettle and Sanpoil. Only Ranger Districts/Sub-basins with listed streams are displayed in the following tables, along with the listed parameter(s).

Table 5--Naches Ranger District 2008 303(d) Streams

Watershed	Sub Watershed	HUC	Stream	Parameter
Little Naches River	Headwater Little Naches River	170300020101	Blowout Creek	Temperature
	Lower American River	170300020107	American River	Temperature
			Bumping River	Temperature
	Lower Little Naches River	170300020109	Crow Creek	Temperature
			Little Naches River	Temperature
	Upper Little Naches River	170300020102	Bear Creek	Temperature
			Little Naches River	Temperature
			Little Naches River, N.F.	Temperature
			Mathew Creek	Temperature
Rattlesnake Creek-Naches River	Lost Creek – Naches River	170300020202	Gold Creek	Temperature
			Naches River	Temperature
	Lower Little Naches River	170300020109	Little Naches River	Temperature
	Lower Rattlesnake Creek	170300020206	Rattlesnake Creek	Temperature
	Nile Creek	170300020203	Nile Creek N.F.	Temperature

Tieton River – Naches River	Lower South Fork Tieton River	170300020304	Tieton River S.F.	Temperature
	Tieton River	170300020308	Tieton River	Temperature

Table 6--Cle Elum Ranger District Section 303(d) Streams

Watershed	SubWatershed	HUC	Stream	Parameter
Cle Elum River	Cooper River	170300010103	Cooper River	Temperature
	Upper Cle Elum River	170300010104	Cle Elum River	Temperature
			Thorp Creek	Temperature
Kachess River – Yakima River	Headwaters Yakima River	170300010301	Keechelus Lake	Dioxin, PCB
			Meadow Creek	Temperature
	Kachess River	170300010303	Gale Creek	Temperature
Taneum Creek – Yakima River	Lower Swauk Creek	170300010502	Swauk Creek	Temperature
	North Fork Taneum Creek	170300010503	Lookout Creek	Temperature
			Taneum Creek, S.F.	Temperature
	South Fork Manastash Creek	170300010508	Manastash Creek, S.F.	Temperature
	Taneum Creek	170300010504	Taneum Creek	Temperature
	Upper Swauk Creek	170300010501	Iron Creek	Temperature
			Swauk Creek	Temperature
			Williams Creek	Temperature

Table 7--Wenatchee River Ranger District 2008 303(d) Streams

Watershed	SubWatershed	HUC	Stream	Parameter
Wenatchee River	Chumstick Creek	170200110705	Chumstick Creek	Dissolved Oxygen
	Eagle Creek	170200110704	Van Creek	pH
	Tumwater Canyon-Wenatchee River	170200110703	Wenatchee River	Dissolved Oxygen

Table 8--Chelan Ranger District 2008 Section 303(d) Streams

Watershed	SubWatershed	HUC	Stream	Parameter
Upper Lake Chelan	Bear Creek-Lake Chelan	170200090206	Railroad Creek	Copper, Lead, Mercury
	Lower Railroad Creek	170200090204	Railroad Creek	Copper
	Upper Railroad Creek	170200090203	Copper Creek	Lead
			Holden Creek	Lead
			Railroad Creek	Copper, Lead, Mercury, Silver

Table 9--Methow Ranger District 2008 303(d) Streams

Watershed	SubWatershed	HUC	Stream	Parameter
Lower Chewuch River	Boulder Creek	170200080406	Chewuch River	Temperature

Fish Species on the Okanogan-Wenatchee National Forest:

There are a number of fish species on the Okanogan-Wenatchee National Forest. Each is listed by location in the following table. Details about habitat and populations are included after the table.

Table 10 Special status fish species occurring on the National Forest by Watershed and Ranger District (the specific distribution of Pacific lamprey is unknown but likely overlaps the distribution of anadromous fish)

Ranger District	Watershed HUC	Watershed Name	Species Present on National Forest
Tonasket	1702000201	Myers Creek	Rainbow, Brook
	1702000203	Toroda Creek	Rainbow, Brook
	1702000401	Upper Sanpoil River	Cutthroat, Rainbow, Brook
	1702000402	West Fork Sanpoil River	Rainbow, Brook
	1702000505	Swamp Creek-Columbia River	Bull trout, Steelhead, Spring Chinook, Cutthroat, Rainbow
	1702000602	Bonaparte Creek-Okanogan River	Rainbow, Brook
	1702000603	Salmon Creek	Cutthroat, Rainbow, Brook
	1702000701	Pasayten River-Similkameen River	Redband
	1702000702	Ashnola River	Cutthroat trout, Redband
	1702000703	Sinlahekin Creek	Cutthroat, Rainbow, Brook
Methow	1702000801	Lost River	Bull trout, Cutthroat, Spring Chinook, Steelhead, Redband, Rainbow
	1702000802	Upper Methow River	Bull trout, Cutthroat, Spring Chinook, Steelhead, Redband, Rainbow
	1702000803	Upper Chewuch River	Bull trout, Cutthroat, Spring Chinook, Redband, Rainbow
	1702000804	Lower Chewuch River	Bull trout, Cutthroat, Spring Chinook, Steelhead, Redband, Rainbow, Brook
	1702000805	Twisp River	Bull trout, Cutthroat, Spring Chinook, Steelhead, Redband, Rainbow, Brook
	1702000806	Middle Methow River	Bull trout, Cutthroat, Spring Chinook, Steelhead, Rainbow, Brook
	1702000807	Lower Methow River	Bull trout, Cutthroat, Spring Chinook, Steelhead, Redband, Rainbow, Brook
Chelan	1702000901	Stehekin River	Cutthroat, Redband, Rainbow
	1702000902	Upper Lake Chelan	Cutthroat, Redband, Rainbow
	1702000903	Lower Lake Chelan	Cutthroat, Redband, Rainbow
Entiat	1702001001	Mad River	Bull trout, Cutthroat, Spring Chinook, Summer Chinook, Steelhead, Sockeye, Redband, Rainbow
	1702001002	Entiat River	Bull trout, Cutthroat, Spring Chinook, Summer Chinook, Steelhead, Sockeye, Redband, Rainbow
	1702001003	Lake Entiat-Columbia River	Bull trout, Cutthroat, Spring Chinook, Summer Chinook, Steelhead, Sockeye, Rainbow
Wenatchee River	1702001101	White River-Little Wenatchee River	Bull trout, Cutthroat, Spring Chinook, Steelhead, Sockeye, Redband, Rainbow
	1702001102	Nason Creek	Bull trout, Cutthroat, Spring Chinook, Steelhead, Redband
	1702001103	Chiwawa River	Bull trout, Cutthroat, Spring Chinook, Steelhead, Redband, Rainbow
	1702001104	Icicle Creek	Bull trout, Cutthroat, Spring Chinook, Summer Chinook, Coho, Steelhead, Sockeye, Redband, Rainbow
	1702001105	Peshastin Creek	Bull trout, Cutthroat , Spring Chinook, Steelhead, Rainbow
	1702001106	Mission Creek	Cutthroat, Spring Chinook, Coho, Steelhead, Rainbow
	1702001107	Wenatchee River	Bull trout, Cutthroat, Spring Chinook, Summer Chinook, Steelhead, Sockeye, Coho, Redband, Rainbow
Cle Elum	1703000101	Cle Elum River	Bull trout, Cutthroat, Pygmy whitefish, Spring Chinook, Coho, Steelhead, Sockeye, Redband, Rainbow
	1703000102	Middle Fork Teanaway River-Teanaway River	Bull trout, Cutthroat, Pygmy whitefish, Spring Chinook, Steelhead, Sockeye,

Ranger District	Watershed HUC	Watershed Name	Species Present on National Forest
			Coho, Redband, Rainbow
	1703000103	Kachess River-Yakima River	Bull trout, Spring Chinook, Steelhead, Cutthroat, Pygmy whitefish, Redband, Rainbow
	1703000104	Wilson Creek-Cherry Creek	Cutthroat, Steelhead
	1703000104	Taneum Creek-Yakima River	Bull trout, Cutthroat, Spring Chinook, Steelhead, Rainbow
Naches	1703000106	Wenas River	Cutthroat trout
	1703000201	Little Naches River	Bull trout, Spring Chinook, Coho, Steelhead, Cutthroat, Redband, Rainbow
	1703000202	Rattlesnake Creek-Naches River	Bull trout, Spring Chinook, Coho, Steelhead, Cutthroat, Rainbow
	1703000203	Tieton River-Naches River	Bull trout, Spring Chinook, Coho, Steelhead, Cutthroat, Sockeye, Redband, Rainbow

As part of the Okanogan-Wenatchee Forest plan monitoring program, stream biota surveys (snorkeling, electroshocking and hook and line methods) and spawning ground surveys for bull trout, have been conducted across the Forest since 1989. Steelhead and spring chinook spawning surveys are available from other agencies including the; USFWS, Washington Department of Fish and Wildlife, various Public Utility Districts and the Yakima Nation. In some subbasins the Forest Service cooperates with external agencies to complete steelhead and spring chinook survey data collection. From these surveys, an extensive fish distribution data layer has been compiled for the Okanogan-Wenatchee. Based on this fish distribution layer and Inland Fishes of Washington (Wydoski and Whitney 2003), there are 37 known and potential native fish species located throughout the OWNF.

Table 11 Native Fish Species Miles of Habitat and Special Status Fish Species on the Okanogan Wenatchee National Forest

Species	Occupied Habitat (miles)	Critical Habitat (miles)	Special Status
Pacific lamprey	15		Sensitive
River lamprey	UNK*		
Western brook lamprey	6		
White Sturgeon	0		
Cutthroat trout (unknown subspecies)	1447		MIS
Westslope Cutthroat trout	185		Sensitive/MIS
Coho	UNK		
Steelhead	470	422	Threatened, MIS
Rainbow trout/redband	864		SensitiveMIS
Sockeye salmon	58		MIS
Spring chinook salmon	375	197 (upper Columbia ESU only)	Endangered (upper Columbia ESU only), MIS
Summer chinook salmon	34		MIS
Pygmy whitefish	22		Sensitive
Mountain whitefish	303		
Bull trout	697	746	Threatened, MIS
Chiselmouth	UNK		
Lake Chub	UNK		

Tui Chub	UNK		
Peamouth	31		
Northern Pikeminnow	43		
Longnose dace	20		
Leopard dace	UNK		
Umatilla Dace	UNK		Sensitive
Speckled dace	29		
Redside shiner	97		
Largescale Sucker	66		
Bridgelip sucker	36		
Longnose sucker	UNK		
Mountain sucker	UNK		
Burbot	62		
Three-spined stickleback	UNK		
Sand roller	6		
Prickly sculpin	UNK		
Mottled sculpin	1		
Paiute sculpin	7		
Slimy sculpin	12		
Torrent sculpin	13		
Sculpin species	404		

*UNK= Unknown

Special Status Fish Species

Threatened and Endangered Species

Upper Columbia River (UCR) Spring Chinook Salmon. On March 24, 1999, NMFS listed UCR Spring-run Chinook salmon as an endangered species (64 FR 14308) and their endangered status was reaffirmed on June 28, 2005 (70 FR 37160). This ESU includes all naturally spawned populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of Rock Island Dam and downstream of Chief Joseph Dam in Washington (excluding the Okanogan River), as well as six artificial propagation programs: the Twisp River, Chewuch River, Methow Composite, Winthrop National Fish Hatchery, Chiwawa River, and White River Spring-run Chinook hatchery programs. The Interior Columbia Basin Technical Recovery Team (ICBTRT) has identified three populations, Methow Entiat and Wenatchee, in one major population group (Eastern Cascades) for this species. A historic population in the Okanogan River has been extirpated (ICBTRT 2005).

The status of spring Chinook salmon populations in the Methow, Wenatchee and Entiat sub-basins is critical. The UCR spring Chinook recovery plan states that for recovery the species must at a minimum, maintain at least 4,500 naturally produced spawners. The minimum number of naturally produced spawners (expressed as 12-year geometric means) should exceed 2,000 each for the Wenatchee and Methow River populations and 500 within the Entiat River. According to the most recent status review conducted by NMFS, the 5-year geometric mean number of total spawners returning to the Wenatchee, Entiat and Methow Rivers are 1,336, 261, and 1,343 respectively. However naturally produced spawners were 489 for the Wenatchee, 112 in the Entiat and 402 returned to the Methow River (Ford 2011). The viability of all three populations is considered to be a high risk (Ford 2011). Ford (2011) notes that while there have been significant efforts to improve habitat, degraded habitat conditions remain a concern both on and off National Forest lands.

UCR spring Chinook are considered to be "stream-type" Chinook salmon. Stream-type Chinook salmon rear for one year (sometimes longer) before migrating to the ocean. Freshwater habitat is thus very important for spring Chinook in the upper Columbia. Upper Columbia spring Chinook adults begin entering the Columbia River in March with the peak migration in April or early May after spending two years in the ocean (4 year old fish) (Chapman et al. 1995). Fifty percent of the run to the upper Columbia pass Priest Rapids and Rock Island dams by mid-May. The fish move into tributaries (to the Columbia) from late April through July and hold in the deeper pools and under cover until spawning (Chapman et al. 1995). Spawning peaks in mid-to late August. Wenatchee Sub-basin spring Chinook spawn in the Chiwawa River, Nason Creek, Little Wenatchee River, White River, and to a lesser extent in the mainstem Wenatchee River between the outlet to Lake Wenatchee and lower Tumwater Canyon. In the Entiat Sub-basin the spring Chinook spawn in the mainstem Entiat River downstream of Entiat falls.

Methow River spring Chinook primarily use the mainstem reaches of the Twisp River, Upper Methow River, Chewuch River and Lost River. Limited spawning has been documented in Gold Creek, Early Winters Creek and Lake Creek. The fry emerge from the gravel in spring. Many fry disperse downstream into the mainstem rivers, others stay in the general area of emergence, while some even move upstream. The fry also move into tributary streams where there is no spawning (Chapman et al. 1995). The alluvial fans of tributaries to the spawning streams can be important rearing areas for spring Chinook in the Wenatchee, Methow, and Entiat sub-basins. Movement generally occurs at night or during periods of turbidity. The fry occupy shallow, slow water on the stream margins associated with cover such as large woody debris, bank vegetation and larger substrate material (Chapman et al. 1995).

As the summer progresses and the fry grow they move into deeper water, with relatively low velocity and with cover. In the Chiwawa and Little Wenatchee Rivers, juvenile spring Chinook are associated with woody debris and multiple channel habitats (Hillman and Miller 1994). Our snorkel surveys show the same patterns of juvenile Chinook habitat use in other tributaries. The juveniles are sensitive to stream temperature, especially increases during the summer. The reported preferred temperature range for juvenile Chinook salmon is between 7.3ºC and 14.6ºC with an upper lethal temperature of 25.1ºC (Lee et al. 1996).

As water temperatures cool in the fall below 10°C there is a movement of juvenile Chinook downstream into the Wenatchee River where the fish over-winter. The fish conceal themselves in the substrate, woody debris and overhanging vegetation during the day (Hillman et al. 1989). Similar movements of juvenile Chinook have also been observed in the Yakima River sub-basin (Fast et al. 1991), and presumably other streams on the Forest.

Lee et al. (1996) state that key habitat factors for juvenile Chinook salmon rearing include streamflow, pool morphology, cover and water temperature. Rearing tends to be most abundant in low gradient, meandering streams. Such habitat matches our own observations in the Wenatchee and Entiat rivers, and those of Chapman et al. (1995). Given that there are at least three major movements of juvenile spring Chinook throughout their freshwater residence: 1) a downstream movement shortly after emergence (although many fish remain in the natal stream and some move upstream and into tributaries; 2) a late fall movement into over winter habitats; and 3) out-migration as smolts; maintaining connectivity between streams and providing diverse habitat and watershed processes is important.

The “native” Okanogan River fish were eliminated or absorbed into other populations (Myers et al. 1998) and thus are not discussed further in this BA. The *Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan* (UCSRB 2007) identifies primary habitat threats to the persistence of UCR spring Chinook salmon as:

- Although land and water management activities have improved, factors such as dams, diversions, roads and railways, agriculture (including livestock grazing), residential development, and historic forest management continue to threaten spring Chinook and their habitat in some locations in the Upper Columbia Basin.

- Water diversions without proper passage routes disrupt migrations of adult spring Chinook.
- Unscreened diversions trap or divert juvenile spring Chinook resulting in reduced survival.
- Hydroelectric passage mortality reduces abundance of migrant spring Chinook.
- Sedimentation from land and water management activities is a cause of habitat degradation in some salmon streams.
- Loss of habitat complexity, off-channel habitat, and large, deep pools due to sedimentation and loss of pool-forming structures such as boulders and large woody debris threatens spring Chinook and their habitat in some locations in the Upper Columbia Basin.

Upper and Mid-Columbia River Steelhead. The UCR steelhead DPS was listed as endangered on August 18, 1997 (62 FR 43937), their status was upgraded to threatened on January 5, 2006 (71 FR 834) and then reinstated to endangered status per U.S. District Court decision in June 2007. The status was updated again to threatened on August 24, 2009 (74 FR 42605). This DPS includes all naturally spawned anadromous steelhead populations below natural and manmade impassable barriers in streams in the Columbia River Basin upstream from the Yakima River, Washington, to the U.S.-Canada border, as well as six artificial propagation programs: the Wenatchee River, Wells Hatchery (in the Methow and Okanogan Rivers), Winthrop NFH, Omak Creek, and the Ringold steelhead hatchery programs. The ICBTRT has identified five populations within this DPS: the Wenatchee River, Entiat River, Methow River, Okanogan Basin, and Crab Creek (ICBTRT 2005). The Crab Creek anadromous component is functionally extirpated (ICBTRT 2007).

The Middle Columbia River (MCR) steelhead DPS was listed as threatened on March 25, 1999 (64 FR 14517) and their threatened status was reaffirmed on June 28, 2005 (70 FR 37160). This DPS includes all naturally spawned populations of steelhead (and their progeny) in streams from above the Wind River, Washington, and the Hood River, Oregon (exclusive), upstream to, and including, the Yakima River, Washington, excluding steelhead from the Snake River Basin. Seven artificial propagation programs are considered part of the DPS: the Touchet River Endemic, Yakima River Kelt Reconditioning Program (in Satus Creek, Toppenish Creek, Naches River, and Upper Yakima River), Umatilla River, and the Deschutes River steelhead hatchery programs. Major watersheds within this DPS include the Klickitat, Fifteen Mile, Deschutes, John Day, Umatilla, Yakima, and Walla Walla River Basins. The ICBTRT (2007) identified 20 populations in four major population groups (Eastern Cascades, John Day River, the Umatilla Rivers/Walla Walla, and the Yakima River). The two MCR steelhead populations on the Forest, Naches River and Upper Yakima are part of the Yakima River major population group. The Yakima River major population group includes two additional populations which are not on the Forest; Toppenish Creek and Satus Creek.

The recovery criteria for the UCR steelhead are for the 12-year geometric mean natural spawning abundance to include; 1,000 spawners each in the Wenatchee and Methow populations, 500 in the Entiat population, and 750 in the Okanogan population. The most recent estimated abundances from Ford (2011) are: Wenatchee River, 795 spawners; Entiat River, 112 spawners; Methow River 468 spawners; and Okanogan River, 147 spawners. Overall, the continued viability for all populations is considered to be at high risk (Ford 2011).

The minimum recovery abundance threshold is 1,500 natural spawners for each of the Naches and Upper Yakima populations. The most recent status review natural spawning abundance is 840 fish in the Naches and 151 fish in the Upper Yakima with the viability of the Upper Yakima population considered to be a high risk (Ford 2011).

Determining the distribution and status of steelhead on the Forest is difficult. In addition to steelhead spawning occurring over an extended time period that coincides with snow runoff, when streams are high and turbid; as noted in (Ford 2011), many steelhead populations along the U.S. West Coast co-occur with conspecific populations of resident rainbow trout. There may be situations where reproductive contributions from resident rainbow trout may mitigate short-term extinction risk for some steelhead DPSs. It is assumed that any benefits to an anadromous population resulting from the presence of a conspecific resident form will be reflected in direct measures of the current status of the anadromous form.

In the Wenatchee Sub-basin, steelhead are known to spawn in Mission Creek, Sand Creek, Chumstick Creek, Eagle Creek, the mainstem Wenatchee River, Peshastin Creek, the lower Icicle, Nason Creek, the Chiwawa River and are believed to spawn in Chiwaukum Creek, Little Wenatchee, and White Rivers. The Mad River is believed to have once been an important steelhead stream in the Entiat sub-basin and steelhead are known to spawn in the lower reaches (steelhead also spawn in the mainstem Entiat River. There are approximately 70 miles of anadromous habitat within the Methow sub-basin. Steelhead use occurs in the sub-basin within the following watersheds; Black Canyon Creek, Gold Creek, Libby Creek, Beaver Creek, Twisp River, Chewuch River, Wolf Creek, Early Winters Creek, Goat Creek, Lost River and the Upper Methow River.

Steelhead use within the Okanogan sub-basin is confined to the mainstem and some larger tributaries, which are below the Forest boundary, although there are efforts to re-introduce steelhead into Salmon Creek and Omak Creek, again below the National Forest boundary. Only headwater streams of this sub-basin are on National Forest lands. Steelhead are prevented from accessing Forest streams due to natural and human induced barriers. These barriers include physical structures such as dams and non-physical barriers such as low flows and high water temperatures.

The two subbasins of the Yakima River that include National Forest lands are the Naches and Upper Yakima. Steelhead have access to much of the Naches subbasin. Steelhead spawn in the mainstem Naches River, Bumping River, Rattlesnake Creek and are believed to spawn in the Little Naches. Steelhead returns to the Upper Yakima River sub-basin have been severely depressed. Many of the few returning fish appear to head into Swauk Creek although distribution is not well known. Streams accessible to anadromous fish with redband/rainbow trout present are considered to support steelhead.

Steelhead destined for streams on the Forest generally enter the Columbia River between May and September and spawn the following spring/early summer. Most spawning is believed to occur between March and June but spawning has been observed in July (Chapman *et al*. 1994).

The eggs usually hatch in four to seven weeks. Timing to emergence depends largely upon water temperature. The colder the water temperature, the slower the hatch develops. Eggs may hatch in 19 days at 59ºF and take 80 days at 41ºF. Timing from spawning to emergence is not known for the upper Columbia. Hillman *et al.* (1989) reported observing steelhead fry within the Wenatchee River in June 1987 while in 1988 found no steelhead before early July. Both years they found fry up to early October.

The preferred temperature range for steelhead as reported by Bjornn and Reiser (1991) is between 10º-13ºC with an upper lethal temperature of 23.9ºC. Bjornn and Reiser (1991) cite studies in Idaho where juvenile salmon and steelhead maintained high densities and grew normally, though daily maximum temperatures reached 24ºC but lasted less than one hour when minimum temperatures dropped to 8º-12ºC. Where temperatures reached 24º-26ºC, but daily minimums only dropped to 15º-16ºC, most young salmon and trout moved upstream or into tributaries where temperatures were lower.

Emergence in the upper portions of the mainstem Yakima appears to be completed by about the first week in July with the bulk of emergence completed by the first week in June. In Satus Creek, a low elevation tributary to the Yakima River flowing through the Yakama Indian Reservation, peak emergence appears to occur between the last week in May and the first week in June, and completed by the third week in June.

Upon emergence steelhead fry are often observed at the stream margins in riffles and cascades. As the fish grow they tend to move to deeper and faster water, often selecting areas with instream boulder cover and overhead turbulent water. Observations in the Wenatchee River system suggest steelhead often choose riffle habitats but can also be associated with woody debris and overhanging vegetation (Chapman *et al*. 1994). Within the Forest steelhead rear for an extended period in freshwater, generally two to three years, but up to seven years (Chapman *et al*. 1994).

In summary, UCR steelhead abundance has increased recently for all four populations found within the Forest but no populations have achieved population recovery goals and the DPS is still considered to be at a high risk of extinction (Ford 2011). Total and natural-origin escapement estimates for MCR steelhead in the Upper Yakima were higher in the most recent brood cycle for all four of the Yakima River populations than in the cycle associated with the pervious status review with a high proportion of natural-origin fish. Steelhead escapements into the Upper Yakima River, remain very low relative to the total amount of habitat available (Ford 2011). Many of the problems affecting steelhead populations occur downstream of the National Forest in the mainstem Okanogan and Columbia Rivers, lower Yakima River and possibly the ocean environment. However as is the case with UCR Chinook, there have been significant efforts to improve habitat for both steelhead DPS but degraded habitat conditions remain a concern (Ford 2011).

The primary habitat threats to UCR steelhead are the same as those listed above for UCR spring Chinook salmon (UCSRB 2007). NMFS (2009) identifies the following habitat limiting factors for MCR steelhead in the Yakima River Basin:

- Fish habitat in the Yakima subbasin is substantially influenced by the development of irrigation systems. Limiting factors include altered hydrology (low summer flow, scouring peak flows due to degraded watershed conditions, high summer delivery flows in mainstem Yakima and Naches rivers, reduced winter and spring flows due to irrigation storage, delivery, and withdrawals); degraded riparian area and LWD recruitment; impaired fish passage (dams, culverts, seasonal push-up dams, entrainment in unscreened diversions);
- Altered sediment routing; degraded water quality;
- Loss of historical habitat because of blocked or impaired fish passage;
- Degraded floodplain connectivity and function (loss of off-channel habitat, side channels and connected hyporheic zone);
- Degraded channel structure and complexity;
- Reduced out-migrant survival in the mainstem Yakima.

As previously discussed CFH has been designated for UCR spring Chinook salmon, UCR steelhead and MCR steelhead. The PCEs for the CFH are displayed in Table 3.Table 11

Bull Trout

The U. S. Fish and Wildlife Service reviewed the status of bull trout (*Salvelinus confluentus*) in 1994 and found that all bull trout in the lower 48 states warranted listing under the Endangered Species Act. Listing however was precluded by other higher priority work. In response to a court order, the USFWS re-assessed the status of bull trout based on the 1994 information. Upon re-analysis the USFWS listed five DPS of bull trout within the conterminous United States in 1998. Bull trout inhabiting the Forest were included within the Columbia Basin DPS. The Columbia Basin bull trout is a Threatened Species. The bull trout DPSs were re-evaluated and listed as the coterminous United States population of the bull trout as threatened on November 1, 1999 (64 FR 58910). The Forest includes four bull trout core areas;

Yakima River, Wenatchee River, Entiat River and Methow River. Core areas reflect the metapopulation structure necessary to recover bull trout and they contain both migratory and spawning habitat. The most recent bull trout critical habitat designation was on October 18, 2010 (50 CFR Part 17).

Within designated critical habitat areas, there are eight PCEs for bull trout which list habitat components essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering (see page 15).

Bull trout are native to all sub-basins on the Forest except they appear to be extirpated from the Chelan Sub-basin and the Okanogan sub-basin(USFWS 2015, Brown 1992). Lake Chelan is considered a Historic Core Area and the Chelan River and Okanogan river are considered to be foraging, migration and over-winter habitat (USFWS 2015) However, new information collected by the Colville Tribe near the mouth of Osoyoos Lake at Zosel Dam in the Okanogan sub-basin on November 10, 2007 documents a migratory adult moving upstream at the fish ladder (Personal communication, Judy Delavergne USFWS, with Matt Karrer USFS, 2008). PIT tagged bull trout from the Wenatchee and Methow core areas have been observed in the Okanogan River (USFWS 2015) Bull trout were once present within the Salmon Creek watershed of the Okanogan Basin. The Okanogan River Basin originates in Canada and flows southward to the Columbia River. According to Scott *et al*. (1973) bull trout are found throughout Canada except in the Okanogan Basin. McPhail and Carveth (1992) note that while bull trout are abundant in the Columbia and Kootenay River systems within Canada, they are absent in the Okanogan and Similkameen systems.

Bull trout occur in sub-basins and watershed across the Forest. Within the Wenatchee Core Area bull trout are known to spawn in the Icicle, Peshastin watersheds, the Chiwaukum River, the Nason, Chiwawa, and White/Little Wenatchee watersheds. The Chiwawa River is a stronghold for bull trout not only in the upper Columbia, but in the interior Columbia Basin as well (Lee et al. 1996). Total redd counts in the Wenatchee Core Area between 2007 and 2011 have ranged between 601 and 312 redds, averaging about 497 redds. The extent to which the current surveys underestimate spawning is unknown as the Icicle redd counts only began in 2008 and spawning surveys are being expanded due to discovery of new spawning locations.[3] The average for specific spawning areas are:

- Icicle Creek (2008-2011) – just over 4 redds
- Peshastin Watersheds - 0 redds over the time period. The last year redds were recorded is 2003
- Chiwaukum watershed – Almost 30 redds
- Nason watershed – 2.6 redds
- Chiwawa watershed – almost 385 redds
- White/Little Wenatchee watershed – almost 77 redds

Bull trout in the Yakima Core Area are currently known to spawn in: Ahtanum Creek (North, Middle and South Forks); in the Naches River system (Rattlesnake Creek and tributaries, Union and Kettle Creeks that flow into the American River and Crow Creek); within the Rimrock Lake system (South Fork Tieton River and Bear Creek, Indian Creek and the upper North Fork Tieton; Deep Creek and the upper Bumping River that flow into Bumping Lake; the North Fork Teanaway River/Deroux Creek; Box Canyon Creek and the upper Kachess River that flow into Kachess Lake; Gold Creek; and in limited numbers in the mainstem Yakima River between Keechelus and Easton. Bull trout arealso found in the Waptus River/Waptus Lake and suspected in the Cle Elum River upstream of Lake Cle Elum. The

[3] Email from Judy Neibauer (USFWS) to Ken MacDonald May 15, 2015; Redd Data. Email includes *Summary of Bull Trout Spawning Ground Surveys and other Bull trout Counts in the Wenatchee, Entiat, and Methow Watersheds 1988-2011*

strongest populations are found in the Rimrock Lake and Bumping Lake systems. Average redd counts between 2010 and 2014 are:

- Ahtanum Watershed – 13 redds
- Naches River tributaries – 93 redds
- Rimrock Lake tributaries – 315 redds
- Bumping Lake tributaries 149 redds
- North Fork Teanaway – only one red during the period in 2013
- Kachess Lake tributaries – 32 redds
- Gold Creek - almost 18 redds

Redds have only sporadically been observed in the mainstem Yakima River between Keechelus and Easton, the North Fork Teanaway River and none have been observed in the upper Cle Elum River and Waptus Lake systems. The redd counts are indicators of population trends but it should be noted that many of the surveys are considered incomplete and high water often precluded completing the third of three surveys that are required for a spawning survey to be considered complete.[4]

Bull trout in the Entiat River Core Area are only known to be found in the Mad River and the Entiat River mainstem. Bull trout redd counts in the Entiat core area between 2007 and 2011 have ranged between 13 and 41, averaging a little over 25 redds. The average number of redds (2007-2011) has been 12 redds and 13 redds in the Mad and Entiat Rivers respectively.[5]

Bull trout spawning within the Methow core area occurs in the Lower Methow watershed, the Twisp watershed, Chewuch watershed, Upper Methow watershed and Lost Creek. Total redd counts in the core area between 2007 and 2011 have ranged between 160 and 223 with an average over the time period of 201 redds including 69 redds in the Lost River (first spawning survey completed in 2011). The 2007-2011 averages within the different watersheds are:

- Lower Methow watershed – 2 redds
- Twisp watershed – 89 redds
- Chewuch watershed – 45 redds
- Upper Methow watershed – 50 redds

The viability status of all the core areas is at some level of risk as displayed in Table 12 based upon USFWS (2008)

Table 12 Bull Trout Population Status

Core Area	Short-term Trend Rank	Threat Rank	Final Rank
Yakima River	Very rapid decline	Substantial, imminent	High risk
Entiat River	Stable	Moderate, imminent	At risk
Methow River	Declining	Moderate, imminent	High risk
Wenatchee River	Stable	Widespread, low severity	Potential risk

The USFWS (2014, 2015) identified habitat threats to the populations within the four core areas included on the Forest. Some of these threats are summarized in the following table.

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[4] Email from Judy Neibauer (USFWS) to Ken MacDonald May 15, 2015; Redd Data. Email includes*: Bull TrRedd Sum2014_Excel*

[5] [5] Email from Judy Neibauer (USFWS) to Ken MacDonald May 15, 2015; Redd Data. Email includes *Summary of Bull Trout Spawning Ground Surveys and other Bull Trout Counts in the Wenatchee, Entiat, and Methow Watersheds 1988-2011*

Table 13 Bull Trout Core Area Threats

Core Area	Threats			
Yakima River	Passage barriers	Instream impacts (entrainment, low instream flows)	Upland/riparian land management (legacy and current timber harvest and roads: recreation; grazing; water temperature	Nonnative fishes (brook trout hybridization, brown trout)
Entiat River	Upland/riparian land management (legacy timber harvest and roads	Instream impacts (entrainment)	Passage barriers	Nonnative fishes (brook trout)
Methow River	Upland/riparian land management (legacy timber harvest and roads; water temperature)	Passage barriers	Nonnative fishes (brook trout)	
Wenatchee River	Upland/riparian land management (legacy and current timber harvest, roads, recreation)	Nonnative fishes (brook trout)		

Both migratory (adfluvial and fluvial forms[6]) and resident life histories are found on the Forest. Spawning occurs between late August and October. The peak of bull trout spawning on the Forest occurs in the last two weeks of September through the first two weeks of October, dependent on water temperature. Spawning is initiated as water temperatures decline in late summer. Spawning generally begins as water temperatures drop to between 11º and 9ºC, with peak spawning activity when water temperatures reach 5º to 6ºC (about 41º-43ºF) (Brown 1992). Fry have been found to take up to 223 days before emerging from the gravel in the Flathead River system (Brown 1992). Assuming a similar incubation period for the Forest, emergence would be expected in mid-April. Craig (1997) estimated emergence in several Yakima River tributaries to be as early as October and possibly as late as July 7 in one stream. In most of his study streams the estimated date of emergence was before the end of April. Juveniles of the migratory life history forms will rear in the spawning tributaries for one to three years before migrating downstream to a larger river or lake. On the Wenatchee portion of the Forest, most migratory adults observed in spawning aggregations are aged five to nine (Brown 1992). It could be assumed that Methow sub-basin bull trout are similar to those of the Wenatchee with respect to reproductive age.

Radio-telemetry studies conducted by the USFWS and Douglas and Chelan County PUDs show that bull trout migrate widely from headwater streams down through the mainstem rivers and even into the Columbia River and sometimes but infrequently between sub-basins). Most of the Entiat bull trout were found in using radio-telemetry studies by the USFWS to depend heavily on the mainstem of the Columbia River to forage and overwinter. Migratory bull trout were also observed above the “Boulder field” (at Snow Creek) on Icicle Creek, which was believed by some to be a passage barrier. Resident bull trout

[6] Adfluvial generally refers to fish that spawn and rear in a river and then migrate to a lake to mature. Fluvial generally refers to fish that spawn and rear in a tributary stream then migrate to a larger river to mature. Resident fish reside in tributary streams their entire life without migrating.

have been observed above the falls on the Little Wenatchee River in Rainy Creek in the Wenatchee sub-basin and above the fall in Early Winters Creek in the Methow sub-basin.

Recovery Plans

Recovery plans have been prepared for UCR spring-run Chinook salmon and both UCR and MCR steelhead (UCRSRB 2007 and NMFS 2009). The USFWS has prepared a revised draft bull trout recovery plan (USFWS 2014) and a draft implementation plan for bull trout recovery (USFWS 2015). The recovery plans include actions to be implemented to recover the species so that they no longer will need protection under the ESA. The Forest will have a key role either implementing or cooperating with other entities to implement the actions. Recovery actions identified in the Upper Columbia Recovery Plan of which the Forest Service would be a key partner include:

Recovery actions identified in the Upper Columbia Recovery Plan of which the Forest is a key partner include:

- Address passage barriers by removing, replacing or fixing artificial barriers (culverts and diversions)
- Reduce sediment recruitment by improving road maintenance
- Reduce the abundance and distribution of brook trout
- Increase habitat diversity, reconnect floodplain and wetlands, restore riparian habitat, increase LWD

Recovery actions identified in the MCR steelhead recovery plan of which the Forest is a key partner include:

- Address Forest Health Issues
- Maintain, upgrade, relocate or abandon forest roads
- Replace culverts
- Improve habitat, restore side channels and floodplains, place LWD
- Reduce dispersed recreation impacts
- Restore tributary headwater meadows

The draft Bull Trout Recovery Plan (USFWS 2014) identifies the following conservation needs for bull trout core areas on the Forest to maintain or expand the current distribution of the bull trout within core areas: maintain stable or increasing trends in bull trout abundance; maintain/restore suitable habitat conditions for all bull trout life history stages and strategies; and conserve genetic diversity and provide opportunities for genetic exchange. Some bull trout recovery actions listed in USFWS (2014, 2015) for which the Forest will be a partner include:

- Maintain, protect and restore riparian habitats
- Reduce impacts to riparian areas, stream banks, stream flow, and water quality
- Reduce impacts from recreation to riparian areas.
- Improve habitat complexity, water quality, and connectivity
- Reduce impacts from transportation networks.
    - .

Especially germane to the Travel Management Project, the USFWS (2015) lists recreation as a habitat threat to all bull trout core areas on the Forest. The recreation effects include legacy and new recreational developments that impact spawning and rearing habitat through the recreationists' construction of rock dams, loss of riparian habitat, compacted stream banks and reduced habitat complexity. Naturally the Forest will play an important role managing this threat on the National Forest.

Magnuson-Stevens Fishery Conservation and Management Act (EFH):

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) of 1996 (as amended) requires the identification EFH for Federally managed fishery species and the implementation of measures to conserve and enhance this habitat as described in Federal Fishery Management Plans (FMP's). Federal agencies are required to review actions authorized, funded or carried out by them to ensure that such actions do not negatively affect any EFH (those waters and substrate necessary to fish for spawning, breeding or growth to maturity). Federal fisheries within the middle and upper Columbia basin which are covered under the MSA (Pacific Coast Salmon FMP) include; Chinook and coho (O. kisutch). Summer run Chinook salmon and Yakima River Spring Chinook salmon will be discussed under the MIS section below.

Coho Salmon. Until the early 1900s, naturally produced coho salmon were widespread throughout the Columbia River Basin. Historical abundance is believed to have centered in the Lower Columbia River; however, some stocks migrated to the Spokane River, over 435 kilometers upriver. All middle and upper Columbia River stocks of coho salmon were drastically reduced or destroyed by construction of impassable mill dams, unscreened irrigation diversions, habitat loss, and overharvest prior to completion of Grand Coulee Dam in1941. The decline in production was widespread throughout the river system and has been attributable to combinations of overharvest and habitat loss. All coho salmon populations spawning above Grand Coulee Dam were eliminated with the completion of the dam as no facilities were provided for fish passage. The extent that the middle and upper Columbia River populations declined during the early part of the century is indicated by counts at the first Columbia River main-stem dam (Rock Island Dam) of 183, 69, 10, 0, 58, 78, 13, 12, 29, 1, and 22, from 1933 to 1943, respectively.

Currently the Confederated Tribes of the Yakama Nation are working to re-establish coho salmon in the Wenatchee River, and Methow River subbasins and the Yakima River basin. In the Wenatchee and Methow subbasins coho salmon from the Lower Columbia River have been introduced with the hope of establishing new Upper Columbia populations. Young coho are acclimated to local rivers before being released and then the returning adults are used as broodstock for the next generation.

Currently the Tribe is working to re-establish self-sustaining coho salmon population in the Yakima basin's upper reaches in the waters above Lake Cle Elum. Dams prevent access to the headwaters and have been a barrier for more than 100 years. There are five dams on lakes feeding the Yakima River. None of the five dams have fish passages. Fish returning to spawn are captured below Cle Elum dam and trucked around it.

Management Indicator Species (MIS)

The 1982 Planning Rule (36 CFR 219.19) directs forests to establish objectives for maintenance and improvement of habitat for MIS. Species are selected as MIS because their population changes may indicate the effects of land management activities (36 CFR 219.19 (a) (1)). Each forest plan alternative is to establish objectives for the maintenance and improvement of habitat for the MIS. The MIS are to be used to estimate the effects of each alternative on fish and wildlife populations. Alternatives are to be evaluated in terms of both the amount and quality of habitat and of the population trends for the MIS. The selection of MIS are to represent, where appropriate (36 CFR 219.19 (a) (1)):

- Endangered and threatened plant and animal species identified on State and Federal lists for the planning area.

- Species with special habitat needs that may be influenced significantly by planned management programs.
- Species commonly hunted, fished or trapped.
- Non-game species of special interest.
- Additional plant or animal species selected because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality.

The MIS under the current Wenatchee Forest Plan are:

- Cutthroat trout
- Bull trout
- Steelhead
- Sockeye salmon
- Spring Chinook salmon
- Summer Chinook salmon

The Okanogan Forest Plan MIS are:

- Cutthroat trout
- Redband/Rainbow trout
- Steelhead
- Spring Chinook
- Brook trout
- Bull trout

The following is a brief discussion describing the MIS on the OWNF that are not listed as threatened or endangered species under the ESA.

MCR spring run Chinook Salmon.
Spring-run Chinook salmon as with the other salmon species have significant cultural importance to Native Americans. MCR spring-run Chinook salmon are found on the Forest within the Yakima Basin. Mid-Columbia spring Chinook return to both the Naches and the Upper Yakima sub-basins. In the Naches, they spawn in the Naches, Lower Bumping, Lower and Middle Tieton, Rattlesnake, American and Little Naches Rivers, and lower Crow Creek. In the Upper Yakima sub-basin, spring Chinook spawn in the mainstem Upper Yakima, the lower Cle Elum and Teanaway Rivers, and Cabin and Swauk Creeks.

Columbia River Summer-run Chinook Salmon.
Summer Chinook salmon are found in the Wenatchee, Okanogan, Lower Yakima, Entiat and Methow subbasins. Currently late or summer run Chinook salmon spawn in the lower part of the mainstem Entiat River, however this population is probably the result of past hatchery releases and it is believed that there never was a natural population in the Entiat River. All summer-run Chinook salmon spawning in the Yakima River, Methow, River and Okanogan River occurs below the National Forest boundary, with spawning occurring within the Forest only in the Wenatchee River. Summer Chinook have been found to be a stable population on the Forest by the NMFS. They are not listed or protected by the ESA. Wenatchee River population has been assessed as Healthy Status by the state of Washington. Wenatchee summer Chinook were identified as a population based on their distinct spawning distribution, river entry timing (June), spawning timing and genetic composition. Spawning takes place throughout the mainstem Wenatchee River from near the outlet at Lake Wenatchee to near the confluence with the Columbia River. Spawning occurs from late September through October. The summer Chinook salmon express an "ocean-type life history. Unlike the spring-run Chinook salmon that generally rear for a year within the natal

river systems, the summer Chinook salmon begin migrating towards the ocean soon after the juvenile fish emerge from the spawning gravel.

Sockeye Salmon

The upper Columbia Basin supports the last two viable sockeye salmon populations in Washington State in the Okanogan and Wenatchee subbasins. The Okanogan population spawns in Canada and rears in Lake Osoyoos and therefore is not found on the Forest. Sockeye salmon are unique in that they generally require a lake environment for rearing. Lake Wenatchee is considered one of three ESUs in the interior Columbia River. The Wenatchee River population spawns predominately in the White and Little Wenatchee Rivers and rears in Lake Wenatchee. Dams extirpated sockeye salmon in the Yakima River basin, however since 2007 the Yakima Nation, Bureau of Reclamation, NMFS and other agencies are studying the feasibility of reintroducing sockeye salmon into the upper Cle Elum Rivers .

West Slope Cutthroat Trout (WSCT).

Westslope cutthroat trout (*Oncorhynchus clarki lewisi*) are the native cutthroat trout subspecies east of the Cascade Mountains. WSCT are currently found in all sub-basins on the Forest. According to Behnke (2002):

> "The historical east-west distribution of the westslope cutthroat trout extended from the Judith River of central Montana (the Missouri River basin) to eastern-slope cascade drainages of the Columbia River (the Yakima, Wenatchee, Entiat, Chelan, and Methow River drainages in Washington) and the John Day River drainage of Oregon. The distribution of the westslope cutthroat trout in the eastern slope of the Cascade drainages and in the John Day River drainage is likely associated with the glacial-era Lake Missoula and the many failures of its ice dam that sent torrential floods of enormous magnitude across eastern Washington."

WSCT are estimated to currently occupy approximately 59% of the species' total historic range and 58% of the historic range in Washington state (May 2009). WSCT occur throughout the Naches, Upper Yakima, Wenatchee, Entiat, Lake Chelan, Methow subbasins but do not naturally occur in the Okanogan subbasin. The range of WSCT on the OWNF has been extended through extensive stocking programs, especially in high mountain lakes since the early 1900s, including WSCT primarily from Twin Lakes and Chelan/Stehekin in central Washington.

There has been genetic testing in many areas to determine the level of hybridization with rainbow trout, which is common, especially where rainbow have been planted and did not historically exist sympatrically with WSCT (Howell and Spruell 2003). WSCT are generally found in headwater streams and alpine lakes, where stream temperatures are cold and human impact is limited. WSCT have been found in channel gradients in excess of 20%, highlighting the importance of protecting steep, low order streams (Latterell *et al*. 2003).

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Redband/Rainbow Trout

Redband/rainbow trout are an MIS under the Okanogan Forest plan. Redband trout (*O.m.gairdneri*) are a form of rainbow trout native to the east side of the Cascade Mountain crest (Behnke 2002). Redband trout have been identified via genetic testing in every sub-basin on the OWNF, though in limited distribution. Identification is the main problem, as rainbow trout from many sources have been, and continue to be, planted in streams and lakes throughout the state to satisfy angler demand.

Redband trout populations may exhibit resident and migratory life histories, including the sea-run form or steelhead. Where resident forms of redband trout occur within the range of steelhead, they are not included as a part of the steelhead ESUs that are listed under the federal ESA.

On March 3, 2013 the Regional Forester for USDA Forest Service Region 6 signed the *Rangewide Conservation Agreement for the Conservation and Management of Interior Redband Trout.* The agreement outlines a process of cooperation, coordination, and data sharing among the entities with either management responsibility or interest for the conservation of interior redband trout. The intent of the agreement is to enhance the cooperation and coordination of interior redband trout conservation efforts. Other signatories include the Regional Foresters of Forest Service Regions 1, 4, and 5; the states of California, Idaho, Nevada, Oregon and Washington, the USDI Bureau of Land Management, the USDI Fish and Wildlife Service; five Indian Tribes and Trout Unlimited.

Brook Trout. (The following discussion was obtained from Reiss *et al.* 2008, page 81).
Brook trout are an introduced char species from the eastern United States that have been planted widely across the state as a game fish. Brook trout have been found to inter-breed with and out-compete native bull trout. Stocking has been much reduced, but many populations are established and thriving. Brook trout are found in every sub-basin on the Forest. Bull trout recovery plans in the Middle Columbia and Upper Columbia Basin list removal of brook trout as a strategy for recovery. However, in the Okanogan Basin where bull trout are not present, brook trout are maintained as an important recreational fishery. Brook trout are also known to have negative impacts on native WSCT populations, in the form of inter-specific competition and predation. Though there is little research on the effect of brook trout stocking on native rainbow populations, habitat overlap would likely create competition between these species as well.

Region 6 Regional Foresters Sensitive Species

Within the National Forest System, a sensitive species is a plant or animal whose population viability is identified as a concern by a Regional Forester because of a significant current or predicted downward trend in abundance or habitat quality that would reduce its distribution. The primary objective of the Sensitive species program is to ensure that federal actions do not contribute to a loss of viability, or cause a significant trend toward listing under the ESA. The following are Region 6 aquatic sensitive species that are suspected and/or known to occur on the OWNF;

- PacificLamprey
- Pygmy Whitefish
- Lake Chub
- Westslope Cutthroat Trout (discussed above)
- Columbia River Interior Redband Trout (discussed above)

Pacific Lamprey (*Entosphenus tridentatus*)

Pacific lamprey is a culturally important the interior Columbia Basin tribes adjacent to the OWNF (Confederated Tribes and Bands of the Yakama Nation and Colville Federated Tribes). Pacific lamprey exhibit an anadromous life history, rearing in freshwater streams, migrating to the ocean where they feed parasitically for several years, and then return to freshwater to spawn. Pacific lamprey distribution on the Forest likely overlaps that of anadromous fish. Washington State lists the pacific lamprey as a taxa of potential concern.

Lake Chub (*Couesius plumbeus*)

Lake Chub have a very limited distribution in Washington State. East of the Cascade Range this species is only known to occur in the Okanogan sub-basin (Wydoski and Whitney 2003). Lake chub use cold, clear water stream and lakes with adequate gravel or cobble for spawning. The lake chub is a Washington state sensitive species.

Pygmy Whitefish.

Pygmy whitefish are known to occur in isolated populations within deep lakes of northern North America as remnants of the last ice age (Wydoski and Whitney 2003). Historically, pygmy whitefish resided in at least 16 lakes in Washington (Hallock and Mongillo 1998). Currently they inhabit only nine. Their demise in six lakes is attributed to piscicides, introduction of exotic fish species and/or declining water quality. On the Okanogan-Wenatchee National Forest, WDFW positively identified pygmy white fish in Lake Chelan and in Lakes Cle Elum, Kachess and Keechelus, above barrier dams. In 2010, the Bureau of Reclamation conducted a fish entrainment (the incidental trapping of any life stage of fish within waterways or structures that carry water being diverted for human uses) study below Keechelus Dam in Kittitas County (USBOR 2011). Pygmy whitefish were the second most common fish captured in the study, but suffered a high mortality rate of about 90%. It is therefore assumed that local dam operations in the Mid and Upper Columbia River and pertinent sub-basins have negatively impacted pygmy whitefish populations as a result of habitat fragmentation. The species is a Washington state sensitive species.

Other Native Fish

Other native species include northern pike minnow, redside shiner, mountain whitefish, chiselmouth, bridgelip sucker, Pacific lamprey, sculpin, dace, and largescale sucker. They are widely distributed but their population abundance and behavior across the Okanogan-Wenatchee NF has not been studied in detail.

Aquatic Invasive Species

Aquatic invasive species are found in and near the Okanogan-Wenatchee National Forest. In particular Eurasian water milfoil occurs throughout the Columbia River. Aquatic invasive species are not yet widely distributed on the Forest. Relevant pathways for distribution of these species include OHV trails and stream crossings by routes, where vehicles, boats and boat trailers can carry them into the waterway.

Existing Condition and Effects of Motorized Vehicle Use

Motor vehicle travel on and off designated National Forest Transportation System (NFTS) routes and utilization of unauthorized routes has had impacts to fish and aquatic species on the Okanogan-Wenatchee National Forest. There are many factors influencing the aquatic environment on the Forest and, in general, motor vehicle use has had an influence on the aquatic ecosystem.

Cross Country Motorized Travel

There are 2.6 million acres currently open to cross country motorized travel, of which approximately 675,000 acres are flat, open and accessible enough to result in the development of unauthorized routes by OHVs. There are 275,416 acres within RRs or RHCAs that are open to cross-country motor vehicle travel. Of these, approximately 79,261 acres have < 40% slope and 50% canopy cover which suggest that cross-country travel is more likely on these acres.

Where motor vehicles are being used in riparian areas and in direct contact with waterways, impacts have included increased erosion of stream banks, which has, in some areas, lead to increased sediment delivery to watercourses. Changes in riparian vegetation have also occurred in these areas resulting in local decreases in riparian ecosystem function.

Increases in sediment and turbidity are widely known to negatively impact aquatic resources including invertebrates and fish (Sigler et al. 1984). The creation and use of unauthorized routes in and near watercourses have altered hydrologic function and contributed to increased sedimentation in the aquatic environment, threatening aquatic species habitat. Riparian areas are of vital importance to aquatic species and have been modified to a generally proportionally small degree across the Okanogan-Wenatchee National Forest, but in some watersheds the proportional impacts are high. This has resulted in site specific decreases in riparian ecosystem functioning. Negative impacts to riparian vegetation have resulted in localized decreases in stream productivity, eroding stream banks, and decreases in stream shading in some areas. Stream productivity has been reduced at the site level as a result of riparian vegetation modification, reduction, or elimination. In these areas, leafy debris or other organic materials are no longer delivered to the stream channel at historic levels. This organic material is consumed by aquatic species including invertebrates, algae, and bacteria as a food source, thus providing a productive and robust aquatic environment supplying food sources for fish.

A decrease in stream shading because of modifications or reductions to riparian vegetation has occurred as a result of motorized uses within riparian areas that have directly impacted vegetation and soils, and likely resulted in localized increases in daily water temperatures through solar temperature loading in some areas. Aquatic species are reliant on natural temperature regimes, and when altered, temperature changes can result in the decreased vigor and production of aquatic populations. Bull trout, for example have the coldest temperature requirements of the salmonid fish native to the Forest. Stream temperature is very important to the aquatic communities' diversity and structure. Water temperature can mediate competitive interactions between fish species. Reeves et al. (1987) found that the interactions between fish were influenced by temperature. Alterations in environmental conditions like temperature may reduce habitat suitability for some species but increase it for others. As discussed earlier in Best Available Science and Rational, increased water temperatures due to management or combined with the warming trends associated with climate change can decrease the amount of suitable habitat for a species and increase competition with non-native species. Increases in stream temperatures may place bull trout in a competitive disadvantage with brook trout where the two species overlap and the potential for native westslope cutthroat trout to hybridize with non-native rainbow trout is greater in streams with higher mean summer water temperatures.

Human uses adjacent to streams whether roads, trails or motorized access for dispersed camping can damage stream bank vegetation. Loss of streambank vegetation can result in stream channel widening and a reduction of large woody debris available for recruitment to the stream. Wider streams with shallow flow are subject to greater amounts of warming. Maintenance of streambank integrity and shade along streams is essential to the maintenance of optimum water temperature and aquatic habitat for naturally occurring biota. As stated above, and generally speaking, these impacts have been proportionally low across the Forest, but may be biologically relevant to aquatic species, for example adjacent to critical habitat for listed species. It is likely that in some areas the daily water temperature changes occurring as a result of the unauthorized creation and maintenance of motor vehicle routes could be measured at the site scale. However, at the sub watershed level (6^{th} level HU) it is likely that these changes would not be measurable. The increased temperature "pollution" would be diluted quickly as water mixes and moves down stream. Dispersed camping impacts to aquatic and CFH are also generally limited to the site scale however there is concern that multiple sites within a subwatershed or watershed may eventually, cumulatively lead to larger scale impacts.

Cross-country motor vehicle travel frequently results in degradation of riparian vegetation, increased bank erosion, nutrient loading, sedimentation, and hydrocarbon pollution to streams; which in turn increases metabolic rate, respiration crushing, and oxygen demand of fish and amphibians (Jennings 1996). Motor vehicles traveling across stream banks degrade those banks, increase future erosion potential, and deliver sediment to streams, increasing turbidity.

In general, off-road travel impacts fisheries and aquatic resources in the form of increased erosion and, consequently, increased sediment delivery to watercourses. The creation of new unauthorized routes and the continued use of previously established unauthorized routes near watercourses and riparian areas are of increased concern because many of these routes are user-created and were never designed to effectively move water off of the route. This can lead to the potential for increased amounts of water being captured and diverted into streams. It can also be disruptive to the hydrologic processes that function to provide the high water quality that aquatic species are dependent upon. In addition to negative impacts to water quality, the effects of cross-country motor vehicle travel include opportunities for motorists to cause direct mortality through the crushing of individual aquatic species as they drive through streams and perennial wet areas.

The proliferation of unauthorized routes has caused disruptions in the aquatic and riparian environment and declines in water quality, negatively affected. Focused use in areas that are unsuited for cross-country motor vehicle travel is also a concern. Unmanaged motor vehicle use has resulted in unplanned roads, trails, erosion, and watershed degradation. Riparian areas are particularly vulnerable to motor vehicle use.

Riparian areas that are of vital importance to aquatic species are impacted through modifications to vegetation and hydrology that occur with the creation and use of un-designed, unauthorized routes. Negative impacts to vegetation can result in decreased stream productivity and decreased stream shading. Stream productivity can be reduced when riparian vegetation is modified, reduced, or eliminated. Once riparian vegetation is impacted, it no longer provides leafy debris or other organic materials to the stream channel. This organic material is consumed by aquatic species including invertebrates, algae, and bacteria as a food source, thus providing a productive and robust aquatic environment supplying food sources for fish.

A decrease in stream shading because of modifications or reductions to riparian vegetation contributes to increases in water temperatures through solar insolation. Aquatic species are reliant on natural temperature regimes, and when altered, temperature changes can result in the decreased vigor and production of aquatic populations. Stream temperature is very important to the aquatic communities' diversity and structure. Alterations in environmental conditions like temperature may reduce habitat suitability for some species but increase it for others. For example, anadromous species require cold water for spawning and rearing. Vehicle travel off designated roads, and use of unauthorized routes within riparian areas is creating disturbed areas unable to reestablish important vegetation and hydrologic function.

The Moon and Runny Rock areas are located at sites of extrusive volcanic bedrock and have long been used by OHV enthusiast as "rock crawl" challenge. Soil development is limited due to the exposed bedrock, and the potential for accelerated erosion and sediment delivery is limited due to the geomorphic and topographic setting. The current use if having no effect on fish habitat, hydrology, or soil resources.

Road and Trail Network

Route density and designated open route density at the watershed level are useful measurements to display the magnitude of these interactions at the watershed scale. Watersheds that have a higher open route density are more likely to produce sediment and alter the flow regime via the mechanisms discussed in Best Available Science and Rationale. Current road densities in FS jurisdiction are 1.2 miles/sq. mile. The open road density of FS system roads in FS jurisdiction is 0.8 miles/sq. mile (ml 2-5) (see Table 22). Current open trail densities in FS jurisdiction are 0.6 miles/sq. mile.

The current road density on National Forest System Land and designated open road density are discussed under Atlernative A and displayed by 5th level HUC in Table 22. At the 5^{th} level current open road densities range from zero to 4.1 mi/mi². Open road density refers to roads that are open to motorized travel. Generally when discussing the impacts of roads to watershed function and fish habitat the term total road density or just road density is used as, while the use of roads has greater potential to contribute sediment and chemicals to streams, as well as provide access to riparian habitat, any road on the landscape will cause some change to watershed processes, whether open or closed. Often the open road density is less than the total road density as roads may be closed seasonally to protect important wildlife habitat (e.g. deer winter range) or they may be administratively closed (e.g. maintenance level 1 roads). However for the existing condition, open road density is considered to be the same as total road density as even though maintenance level 1 roads are closed to public travel, in reality, since the Forest is generally open to cross-country travel, the level 1 roads are open to motorized travel unless specifically closed by administrative order that closes the road or area to cross-country travel.

Cedarholm et al. (1981) found that the presence of 2.5 km/km2 (4.0 mi/mi^2) of gravel-surfaced roads undergoing an average distribution of road uses is found to be responsible for producing sediment at 2.6-4.3 times the natural rate in a drainage basin. Lee *et al* (1996) found strong fish populations were generally found where road densities were less than 1.0 $mi/mi^{2.}$ Similarly, in *A Framework to Assist in Making Endangered Species Act Determinations of the Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale* (USFWS 1998), road densities less than 1.0 mi/mi^2 are considered properly functioning, densities between 1.0 mi/mi^2 and 2.4 mi/mi^2 are considered functioning at risk, while those greater than 2.4 mi/mi^2 are considered not functioning with respect to aquatic impacts of road density. It is important to note that viewing route density at the 5^{th} HU scale is a more appropriate scale than to view density at the Forest Scale. Densities are being represented at the 5^{th} HU in this analysis because it is a fine enough scale to isolate conditions of concern. The effects to fish populations due to high road densities are not just due to the presence of the roads but are an indicator of overall human uses and disturbances in a watershed, including recreation.

While motorized vehicle use varies across the Forest, the proportional impacts vary as well. Many of the aquatic environments across the Forest are not substantially affected by motorized vehicle use, but in areas where use is higher, or habitats are particularly vulnerable, even low to moderate motorized vehicle use can have a substantial effect on watershed and aquatic resources. Route density across the Forest is currently having variable impacts. On Forest Service lands, 23 watersheds (43 percent) are properly functioning with regard to road density, 23 (43 percent) are functioning at risk, and 7 (13 percent) are not properly functioning[7].

The USFWS (2015) has identified some areas of the Forest, where recreation access including unauthorized user created routes (which access dispersed recreation) in riparian areas are a concern for bull trout recovery.. Some of the streams where recreation access is a concern include the Twisp River, Early Winters Creek, Wolf Creek, Lost Creek, Lake Creek, Chewuch River and Upper Methow River in

[7] The density represented does not include unauthorized user created routes. Surveys were not done to identify the real extent of unauthorized user created routes. The numbers above under represent the current conditions on the ground.

the Methow core area; Icicle Creek, the Chiwawa River, Nason Creek the White and Little Wenatchee Rivers in the Wenatchee core area; and an overall concern in the Yakima and Entiat core areas.

Alternatively, motorized vehicle use in a watershed like the Stehekin River has a proportionally low impact on aquatic and watershed resources. Road density is very low and there are likely few impacts to aquatic and watershed resources in that watershed that could be identified at broader than the site scale since no listed fish are found in this watershed.

Currently there are 1,313 miles of road in RR/RHCA. This includes Non-Forest Service System roads, unauthorized roads, and Forest Service (FS) system Maintenance Level 1-5 roads (ML–1 are existing system roads managed as closed but without legal closure). There are 1071.5 miles of FS system road (ML 1-5) in RR/RHCA, and 827.8 miles of Designated Open FS System roads in RR/RHCAs across the Forest. The proximity of these roads to streams adds to their potential to have impacts on the riparian and aquatic environment, threatened and endangered species, sensitive, and MIS. Table 14. displays the current acreage of RRs/RHCAs with roads and the T&E or MIS potentially affected.

Table 14 Current Acreage of RR/RHCAs and TES, MIS and Sensitive Species within 300 feet of Roads*

Watershed	Acres within 300 feet of open roads within RR/RHCA	Species with habitat within 300 feet of open roads
1702000209 Myers Creek	229	Rainbow, Brook
1702000211 Rock Creek-Kettle River		
1702000212 Toroda Creek	853	Rainbow, Brook
1702000401 Upper Sanpoil River	152	Cutthroat, Rainbow, Brook
1702000402 West Fork Sanpoil River	1278	Rainbow, Brook
1702000505 Swamp Creek-Columbia River	289	Bull trout, Steelhead, Spring Chinook, Cutthroat, Rainbow
1702000615 Inkaneep Creek-Okanogan River	126.5	
1702000616 Antoine Creek-Okanogan River	114	
1702000617 Bonaparte Creek	298	Rainbow, Brook
1702000618 Tunk Creek-Okanogan River	48	
1702000620 Salmon Creek	1358	Cutthroat, Rainbow, Brook
1702000621 Scotch Creek-Okanogan River	21	
1702000622 Loup Loup Creek-Okanogan River	96	

1702000701 Pasayten River	0.2	Redband
1702000702 Castle Creek-Similkameen River		
1702000713 Headwaters Ashnola River		Redband
1702000714 Ewart Creek		
1702000718 Toats Coulee Creek	146	
1702000719 Sinlahekin Creek	2	Cutthroat, Rainbow, Brook
1702000801 Lost River	28	Bull trout, Cutthroat, Spring Chinook, Steelhead, Redband, Rainbow
1702000802 Upper Methow River	474	Bull trout, Cutthroat, Spring Chinook, Steelhead, Redband, Rainbow
1702000803 Upper Chewuch River	749	Bull trout, Cutthroat, Spring Chinook, Redband, Rainbow
1702000804 Lower Chewuch River	4425	Bull trout, Cutthroat, Spring Chinook, Steelhead, Redband, Rainbow, Brook
1702000805 Twisp River	1908	Bull trout, Cutthroat, Spring Chinook, Steelhead, Redband, Rainbow, Brook
1702000806 Middle Methow River	3066	Bull trout, Cutthroat, Spring Chinook, Steelhead, Rainbow, Brook
1702000807 Lower Methow River	2043	Bull trout, Cutthroat, Spring Chinook, Steelhead, Redband, Rainbow, Brook
1702000901 Stehekin River	14	Cutthroat, Redband, Rainbow
1702000902 Upper Lake Chelan	332	Cutthroat, Redband, Rainbow
1702000903 Lower Lake Chelan	771	Cutthroat, Redband, Rainbow

1702001001 Mad River	962	Bull trout, Cutthroat, Spring Chinook, Summer Chinook, Steelhead, Sockeye, Redband, Rainbow
1702001002 Entiat River	2282	Bull trout, Cutthroat, Spring Chinook, Summer Chinook, Steelhead, Sockeye, Redband, Rainbow
1702001003 Lake Entiat-Columbia River	1984	Bull trout, Cutthroat, Spring Chinook, Summer Chinook, Steelhead, Sockeye, Rainbow
1702001004 Lynch Coulee-Columbia River		
1702001101 White River-Little Wenatchee River	1258	Bull trout, Cutthroat, Spring Chinook, Steelhead, Sockeye, Redband, Rainbow
1702001102 Nason Creek	952	Bull trout, Cutthroat, Spring Chinook, Steelhead, Redband
1702001103 Chiwawa River	1575	Bull trout, Cutthroat, Spring Chinook, Steelhead, Redband, Rainbow
1702001104 Icicle Creek	729	Bull trout, Cutthroat, Spring Chinook, Summer Chinook, Coho, Steelhead, Sockeye, Redband, Rainbow
1702001105 Peshastin Creek	1092	Bull trout, Cutthroat , Spring Chinook, Steelhead, Rainbow
1702001106 Mission Creek	809	Cutthroat, Spring Chinook, Coho, Steelhead, Rainbow
1702001107 Wenatchee River	2733	Bull trout, Cutthroat, Spring Chinook, Summer Chinook, Steelhead, Sockeye, Coho, Redband, Rainbow
1703000101 Cle Elum River	1366	Bull trout, Cutthroat,

		Pygmy whitefish, Spring Chinook, Coho, Steelhead, Sockeye, Redband, Rainbow
1703000102 Middle ForkTenaway River-Tenaway River	1033	Bull trout, Cutthroat, Pygmy whitefish, Spring Chinook, Steelhead, Sockeye, Coho, Redband, Rainbow
1703000103 Kachess River-Yakima River	2271	Bull trout, Spring Chinook, Steelhead, Cutthroat, Pygmy whitefish, Redband, Rainbow
1703000104 Wilson Creek-Cherry Creek	298	Cutthroat, Steelhead
1703000105 Taneum Creek-Yakima River	3465	Bull trout, Cutthroat, Spring Chinook, Steelhead, Rainbow
1703000106 Wenas River	467	Cutthroat trout
1703000201 Little Naches River	3544	Bull trout, Spring Chinook, Coho, Steelhead, Cutthroat, Redband, Rainbow
1703000202 Rattlesnake Creek-Naches River	3658	Bull trout, Spring Chinook, Coho, Steelhead, Cutthroat, Rainbow
1703000203 Tieton River-Naches River	4148	Bull trout, Spring Chinook, Coho, Steelhead, Cutthroat, Sockeye, Redband, Rainbow
1703000301 Ahtanum Creek		
1711000504 Three Fools Creek-Lightning Creek		Bull trout, Redband, Rainbow
1711000505 Ruby Creek	299	Bull trout, Cutthroat, Redband, Rainbow
1711000506 Ross Lake-Skagit River		
Total	53744	

*Distribution of Umatilla dace, pygmy whitefish and river lamprey is largely unknown

There are currently 677.4 miles of roads adjacent to CFH. This includes Non-FS system roads, unauthorized[8], and FS system ML (1-5). There are 274.7 miles of FS system roads (ML 1-5) adjacent to CHF and 259.5 miles of Designated Open FS System roads in CHF. The proximity of these roads adds to their potential to have impacts on the aquatic environment and the PCEs of CFH. Their occurrence by watershed is shown in Table 21.

Road/Stream Crossings

Road/stream crossings may contribute sediment directly to streams, and in some cases increase the potential for contributing chemical contaminants, including petrochemicals. There are 10,506 road/stream crossing, 7,150 FS system road crossings, and 709 motorized trail crossings on the Forest (See Table 15 below). Since none of the alternatives would decommission any roads, the number of crossings would not change. Therefore, this is not discussed in the Direct/Indirect Effects section of Environmental Consequences. The effects are included in the Cumulative Effects Analysis.

Table 15--Current number of National Forest System Road, Trail, and OHV Trail stream crossings by watershed

Watershed	All Road Crossings (NFS, Private)	NFS Only (ML 1-5) Road Crossings
1702000209 Myers Creek	46	37
1702000211 Rock Creek-Kettle River	0	0
1702000212 Toroda Creek	131	79
1702000401 Upper Sanpoil River	35	25
1702000402 West Fork Sanpoil River	286	187
1702000505 Swamp Creek-Columbia River	71	46
1702000615 Inkaneep Creek-Okanogan River	46	31
1702000616 Antoine Creek-Okanogan River	72	39
1702000617 Bonaparte Creek	118	70
1702000618 Tunk Creek-Okanogan River	53	37
1702000620 Salmon Creek	127	102
1702000621 Scotch Creek-Okanogan River	40	16
1702000622 Loup Loup Creek-Okanogan River	39	32
1702000701 Pasayten River	0	0
1702000702 Castle Creek-Similkameen River	0	0
1702000713 Headwaters Ashnola River	0	0
1702000714 Ewart Creek	0	0
1702000718 Toats Coulee Creek	18	15
1702000719 Sinlahekin Creek	1	1
1702000801 Lost River	3	2
1702000802 Upper Methow River	111	56

[8] The Forest does not have a full inventory of unauthorized routes that have been identified. It is likely more unauthorized roads exist than have been inventoried.

1702000803 Upper Chewuch River	20	20
1702000804 Lower Chewuch River	568	464
1702000805 Twisp River	262	169
1702000806 Middle Methow River	565	407
1702000807 Lower Methow River	288	206
1702000901 Stehekin River	8	1
1702000902 Upper Lake Chelan	16	15
1702000903 Lower Lake Chelan	162	124
1702001001 Mad River	100	94
1702001002 Entiat River	283	237
1702001003 Lake Entiat-Columbia River	678	543
1702001004 Lynch Coulee-Columbia River	1	0
1702001101 White River-Little Wenatchee River	162	127
1702001102 Nason Creek	636	365
1702001103 Chiwawa River	156	110
1702001104 Icicle Creek	155	127
1702001105 Peshastin Creek	318	186
1702001106 Mission Creek	244	129
1702001107 Wenatchee River	1963	971
1703000101 Cle Elum River	162	117
1703000102 Middle Fork Tenaway River-Tenaway River	139	89
1703000103 Kachess River-Yakima River	495	322
1703000104 Wilson Creek-Cherry Creek	84	29
1703000105 Taneum Creek-Yakima River	550	437
1703000106 Wenas River	91	90
1703000201 Little Naches River	425	347
1703000202 Rattlesnake Creek-Naches River	373	350
1703000203 Tieton River-Naches River	327	260
1703000301 Ahtanum Creek	5	0
1711000504 Three Fools Creek-Lightning Creek	0	0
1711000505 Ruby Creek	73	39
1711000506 Ross Lake-Skagit River	0	**0**
Total	10506	7150

*These numbers do not include unauthorized user created crossings

Motorized Trails

There would be no change in the mileage of motorized trails in RR/RHCAs as none of the alternatives change the existing motorized trail system. There are currently 182.9 miles of motorized trails in RR/RHCAs which would continue to impact vegetation, soil though accelerated erosion, water due to more efficient runoff, and subsequent impacts to aquatic habitat and organisms by increasing fine sediment to streams and reducing shade within the RR/RHCAs as described in Best Available Science and Rationale. The effects of motorized use on trails is do not change by alternative so those effects are not discussed in the Direct and Indirect section of the Environmental Consequences. They are included in the Cumulative Effects section

Table 16— Miles of Forest Service system Motorized Trail within Riparian Reserves/Riparian Habitat Conservation Areas

Watershed	All Alternatives
1702000209 Myers Creek	0.4
1702000615 Inkaneep Creek-Okanogan River	0.8
1702000616 Antoine Creek-Okanogan River	0.1
1702000620 Salmon Creek	1.3
1702000804 Lower Chewuch River	1.2
1702000806 Middle Methow River	7.5
1702000807 Lower Methow River	4.4
1702000902 Upper Lake Chelan	5.2
1702000903 Lower Lake Chelan	2.6
1702001001 Mad River	28.3
1702001002 Entiat River	14.8
1702001003 Lake Entiat-Columbia River	1.2
1702001101 White River-Little Wenatchee River	0.0
1702001102 Nason Creek	0.0
1702001103 Chiwawa River	4.4
1702001104 Icicle Creek	0.2
1702001105 Peshastin Creek	0.8
1702001106 Mission Creek	8.9
1703000101 Cle Elum River	4.2
1703000102 Middle ForkTenaway River-Tenaway River	25.0
1703000103 Kachess River-Yakima River	1.1
1703000104 Wilson Creek-Cherry Creek	8.9
1703000105 Taneum Creek-Yakima River	28.5
1703000106 Wenas River	1.0
1703000201 Little Naches River	17.3
1703000202 Rattlesnake Creek-Naches River	7.0
1703000203 Tieton River-Naches River	7.9
Total	**182.9**

There are currently 709 motorized trail-stream crossings (see Table 17). Since there would be no adoption of unauthorized trails, the number of stream crossings from the NFS trail system would not change. Under the current conditions, unauthorized user built OHV trails and associated stream crossings is expected continue to exist and receive use, but the magnitude of effects in each watershed is unknown.. Over time, it is likely more and more unauthorized trails will develop, delivering more eroded sediment to streams, increasing potential impacts to aquatic habitat and organisms. The identification of travel corridors and closing the forest to cross-country travel however should improve the Forest's ability to take enforcement action on unauthorized uses. The current magnitude of the effects of motorized trails to water quality and aquatic habitat on the Forest is not known, although site-specific impacts have been observed. As mentioned above, trails that cross streams offer direct pathways for eroded sediment to be delivered to a watershed which can have subsequent effects to aquatic habitat and organisms such as filling interstitial spaces of gravels used by adults for spawning and juveniles for rearing, decreasing oxygen availability to eggs and alevin, and reducing microorganism and insect productivity, although to a lesser extent than road/stream crossings because of their reduced footprint and use.

Table 17 Number of Motorized Trail/Stream Crossings by Watershed

Watershed	NFS Motorized Trail Crossings
1702000209 Myers Creek	0
1702000211 Rock Creek-Kettle River	0
1702000212 Toroda Creek	0
1702000401 Upper Sanpoil River	0
1702000402 West Fork Sanpoil River	0
1702000505 Swamp Creek-Columbia River	0
1702000615 Inkaneep Creek-Okanogan River	5
1702000616 Antoine Creek-Okanogan River	1
1702000617 Bonaparte Creek	0
1702000618 Tunk Creek-Okanogan River	0
1702000620 Salmon Creek	14
1702000621 Scotch Creek-Okanogan River	0
1702000622 Loup Loup Creek-Okanogan River	0
1702000701 Pasayten River	0
1702000702 Castle Creek-Similkameen River	0
1702000713 Headwaters Ashnola River	0
1702000714 Ewart Creek	0
1702000718 Toats Coulee Creek	0
1702000719 Sinlahekin Creek	0
1702000801 Lost River	0
1702000802 Upper Methow River	0
1702000803 Upper Chewuch River	0
1702000804 Lower Chewuch River	3
1702000805 Twisp River	0
1702000806 Middle Methow River	12
1702000807 Lower Methow River	10
1702000901 Stehekin River	0

1702000902 Upper Lake Chelan	22
1702000903 Lower Lake Chelan	6
1702001001 Mad River	32
1702001002 Entiat River	41
1702001003 Lake Entiat-Columbia River	21
1702001004 Lynch Coulee-Columbia River	0
1702001101 White River-Little Wenatchee River	0
1702001102 Nason Creek	0
1702001103 Chiwawa River	24
1702001104 Icicle Creek	3
1702001105 Peshastin Creek	3
1702001106 Mission Creek	43
1702001107 Wenatchee River	0
1703000101 Cle Elum River	24
1703000102 Middle ForkTenaway River-Tenaway River	76
1703000103 Kachess River-Yakima River	14
1703000104 Wilson Creek-Cherry Creek	47
1703000105 Taneum Creek-Yakima River	122
1703000106 Wenas River	12
1703000201 Little Naches River	107
1703000202 Rattlesnake Creek-Naches River	30
1703000203 Tieton River-Naches River	36
1703000301 Ahtanum Creek	1
1711000504 Three Fools Creek-Lightning Creek	**0**
1711000505 Ruby Creek	0
1711000506 Ross Lake-Skagit River	0
Total	709

Motorized Access for Dispersed Camping

Motorized access to dispersed camping is currently occurring in an unmanaged pattern adjacent to roads in areas open to cross country motorized travel. Of the 275,416 acres of Riparian Reserves/RHCAs where cross country motorized access is not prohibited, 79,261 acres have slopes less than 40% and less than 50% vegetative cover. This can serve as a reasonable upper bound for the current acreage of Riparian Reserves/RHCAs where most of the motorized access for dispersed camping is currently occurring. Of the 1,115 inventoried user created unauthorized access routes to dispersed recreation across the Forest, around 50 percent (554) are in RRs/RHCAs. Of these, 194 are considered roadside parking (within 30 feet of the road) and 301 are routes that access dispersed recreation opportunities.

Dispersed camping sites, and particularly vehicle access to dispersed sites have many characteristics in common with other forms of vehicle use across the Forest. Among the potential impacts of vehicle use to access dispersed sites are bare ground, compacted soils, erosion, changes in hydrology, sediment delivery to streams, removal of vegetation, impacts to stream banks, decreases in shading. These wide ranging effects are discussed more thoroughly in Best Available Science and Rationale, and can affect aquatic habitat and organisms as previously discussed.

Over the last thirty years, the Forest has implemented actions to contain parking access to dispersed campsites. In the late 1980's areas along the Icicle River on the Wenatchee River Ranger District were closed to dispersed camping and motor vehicle use adjacent to riparian areas. In the mid-1990's the Methow Valley Ranger District developed the "Respect the River" program, which targeted popular dispersed recreation sites near important fish habitat along the Chewuch River, and defined and limited motorized access route to some locations. Restoration efforts along access routes and within campsites included soil de-compaction and stream bank plantings. Rock or wood barriers were also installed to limit the size and area of disturbance at the sites, and to limit motorized vehicle access within riparian areas. This program spread across the Forest and similar actions have since occurred on the Cle Elum, Naches, and Wenatchee River Ranger Districts, defining sites and decreasing motorized access to dispersed sites within riparian areas. These sites are referred to as "Improved Sites" in this analysis. A variety of other actions has occurred on the districts, and is summarized in Table 18.

While these efforts have been largely effective at reducing impacts at some locations, continued use, and increases in the size and number of sites in other areas are perpetuating impacts to riparian areas and aquatic habitat. By not allowing cross-country travel and identifying designated routes and corridors the Forest should be in a better position to enforce unauthorized uses including camping adjacent to but outside the boundaries of the Improved Sites.

Table 18 Actions Taken to Reduce Environmental Impacts of Dispersed Camping

Ranger District	Drainage/Watershed	Examples of Actions Taken	Results
Wenatchee River Ranger District	Icicle Drainage	Closed to disperse camping and motorized access.	Reduced riparian impacts and eliminated dispersed camping opportunities in the Icicle Drainage.
Cle Elum Ranger District	Cle Elum Reservoir, Cooper River, Upper Cle Elum River Drainage, Box Canyon, Teanaway, Buck Meadows (Manastash Drainage),	In portions of all these areas, closed critical riparian areas to vehicle access. In some instances altered existing campsite's "foot print"; or designated parking spurs by placing boulders; de-compacted soils and planted vegetation. Eliminated multiple dispersed sites by entirely closing one mile length of road - surfaced ripped and debris added. Closed meadow and built developed campground to accommodate former dispersed use. Up to 30 portable rental toilets placed in highest use riparian dispersed areas during peak summer season.	Reduced vehicle impacts to riparian zones. Reduced erosion created by impacted soils. In places, restricted recreation use by closing access points. Reduced impacts caused by poor human sanitation disposal practices.
Chelan Ranger District	Antilon Lake/Lake Chelan	Special Order #303 signed 5/8/1996. Restricts camping to designated sites and driving to existing open roads.	Curtailed off road travel and the proliferation of new dispersed campsites.
Chelan Ranger District	First Creek/Lake Chelan	Annual Special Order (2013, 2014). Prohibits Camping in a portion of the First Creek Drainage on FS lands on	Reduced trash, human waste, high speed traffic on 1st Creek Road, and shooting on FS lands.

		Memorial Day Weekend.	Increased public safety.
Chelan Ranger District	Lake Chelan Watershed	Special Order #878 signed 7/25/2013. Prohibits camping and campfires in Echo Ridge Trail System.	Reduced impacts to trail based recreation from activities associated with camping (especially target shooting). Reduced trash at trailheads used for camping. Reduced potential for wildfire from unattended campfires. Increase in public safety.
Tonasket Ranger District	Krueger dispersed sites near Conconully	Closed road access and removed old toilet building, restored vegetation in dispersed campsites.	Reduced vehicle impacts and garbage dumping.
Entiat Ranger District	Pine Flat Campground in Mad River drainage	Removed user built camp sites along riparian zone in campground, and rehabbed area.	Reduced impacts to riparian zone vegetation and fish. Reduced availability of established dispersed campsites.
Naches Ranger District	Little Naches, American River, Bumping, Naches Mainstem, Rattlesnake, South Fork Tieton Watersheds	Work has been completed at approximately 50 dispersed sites within these watersheds to control traffic using barriers to keep vehicles off streams, and educate the public through signing about low impact camping activities. CXT toilets were placed at several locations to minimize human waste impacts. Buck and pole fencing was installed at about 15 dispersed sites within these watersheds to control vehicles and minimize impacts to stream banks and sensitive meadow/hardwood areas.	Reduce riparian impacts from vehicles to vegetation and water. Reduce sanitation impacts to riparian zones and to human health concerns. . Modified motorized access for dispersed camping in some locations, but allowed access and camping to continue in these desirable areas.
Methow Valley Ranger District	Chewuch Watershed	Modified approximately 50 popular dispersed campsites along the river by defining access routes, building buck and pole fences to confine camping arears- keeping them away from river's edge.	Reduced impacts to riparian zone vegetation and fish. Modified motorized access for dispersed camping in some locations, but allowed access and camping to continue in these desirable areas.

While the Travel Management Project does not change the road system, areas with higher road and trail use may be expected to potentially pose more risk to aquatic habitat than areas with less human use. The potential for impacts may be greater where dispersed camping is expected to occur due to the continued disturbance to stream banks soils and vegetation caused by campsites and human foot traffic. Additionally, camping adjacent to spawning areas may result in harassment to spawning fish and trampling redds causing egg mortality. The risk may be greatest to spring Chinook salmon, bull trout spawning as well as sockeye salmon as these fish spawn in late summer or fall while camping is still a popular activity.

Environmental Consequences

Direct and Indirect Effects

The following table includes the indicators for fish, hydrology, and soil. The effects are described under the individual alternative sections below. The changes in open road densities, miles of open roads in Riparian Reserves or RHCAs and acres of riparian reserves or RHCAs within designated corridors are relative indicators of the potential risks (or conversely benefits) of the alternatives to aquatic habitat and MIS, sensitive and T&E fish species. Additionally, the miles of open road within 300 feet of Critical Fish Habitat and the acres of corridors within 300 feet of Critical Fish Habitat indicate the relative risks (or conversely benefits) of the alternatives to provide for the PCEs as well as sensitive and MIS species since sensitive and MIS species occupy many of the same watersheds as ESA listed fish on the Forest (see Table 10).

Table 19 Comparison of Fish/Water/Soil Indicators

Indicator	Existing Condition	Alt A	Alt B	Alt C	Alt D
Acres open to Cross-Country Motor Vehicle Travel	2.6 million acres	2.6 million acres	33 acres	33 acres	33 acres
Overall Open Road Density	1.1 miles/sq. mile	1.1 miles/sq. mile	0.7 miles/sq mile	0.7 miles/sq mile	0.7 miles/sq mile
Number of 5th Level HUs with open road density < 1 mi/mi²	23 HUs	23 HUs	29 HUs	29 HUs	29 HUs
Number of 5th Level HUs with open road density between 1 mi/mi² and 2.4 mi/mi²	23 HUs	23 HUs	22 HUs	22 HUs	22 HUs
Number of 5th Level HUs with open road density >2.4 mi/mi²	7 HUs	7 HUs	2 HUs	2 HUs	2 HUs
Miles of Open FS Road in Riparian Reserves or RHCAs	1,072 miles	1,072 miles	828 miles	828 miles	828 miles
Miles of Open FS Road within 300 feet of Critical Fish Habitat	275 miles	275 miles	260 miles	260 miles	260 miles
Acres of Riparian Reserves or RHCAs within designated corridors	n/a	53,774 acres*	20,457 acres	14,401 acres	53,744 acres
Acres of Corridors within 300 feet of Critical Fish Habitat	n/a	15,175 acres*	5,042 acres	0 acres	15,175 acres

*Alternative A would not designated Corridors, so the number of acres within Riparian Areas or RHCAs, within 300 feet on both sides of all open roads is displayed as a point of comparison. There would be no limitations on where motorized vehicles could be driven within these acres in Alternative A.

The following table shows the miles of road within each watershed that would be open within riparian reserves by alternative.

Table 20 Changes in Miles of FS System Roads in RR/RHCAs (total shown for context*)

Watershed	All Roads in RR/RHCA (FS sys, Non-FS) miles	Action Alts Open Roads (FS ML 2-5, Non-FS) in RR/RHCA miles	FS sys Roads in RR/RHCA miles	Action Alts FS sys Open (ML 2-5) in RR/RHCA miles
1702000209 Myers Creek	5.9	3.4	4.8	3.1

1702000211 Rock Creek-Kettle River	0	0	0	0
1702000212 Toroda Creek	26.6	18.6	19.7	14.0
1702000401 Upper Sanpoil River	8.4	2.6	5.0	1.7
1702000402 West Fork Sanpoil River	37.5	19.5	27.8	18.6
1702000505 Swamp Creek-Columbia River	6.8	4.2	4.9	3.9
1702000615 Inkaneep Creek-Okanogan River	5.1	1.5	3.7	1.3
1702000616 Antoine Creek-Okanogan River	5.5	1.4	2.3	1.3
1702000617 Bonaparte Creek	8.3	4.0	5.9	3.7
1702000618 Tunk Creek-Okanogan River	2.8	0.5	1.6	0.4
1702000620 Salmon Creek	32.4	22.8	28.7	20.7
1702000621 Scotch Creek-Okanogan River	1.0	0.7	0.4	0.3
1702000622 Loup Loup Creek-Okanogan River	1.3	0.8	1.0	0.8
1702000701 Pasayten River	0	0	0	0
1702000702 Castle Creek-Similkameen River	0	0	0	0
1702000713 Headwaters Ashnola River	0	0	0	0
1702000714 Ewart Creek	0	0	0	0
1702000718 Toats Coulee Creek	3.6	2.0	2.9	1.8
1702000719 Sinlahekin Creek	0.0	0.0	0.0	0.0
1702000801 Lost River	0.4	0.2	0.3	0.1
1702000802 Upper Methow River	12.3	11.5	6.9	6.3
1702000803 Upper Chewuch River	12.8	12.1	12.8	12.1
1702000804 Lower Chewuch River	94.6	73.6	81.6	70.3
1702000805 Twisp River	47.6	29.8	37.6	28.5
1702000806 Middle Methow River	72.8	51.6	59.8	46.8
1702000807 Lower Methow River	52.9	35.4	46.1	33.1
1702000901 Stehekin River	0.9	0.9	0.1	0.1
1702000902 Upper Lake Chelan	5.2	5.2	4.3	4.3
1702000903 Lower Lake Chelan	16.1	13.5	14.1	11.8
1702001001 Mad River	21.3	15.3	20.5	14.5
1702001002 Entiat River	60.2	45.2	56.0	41.1
1702001003 Lake Entiat-Columbia River	48.8	39.6	40.2	32.1
1702001004 Lynch Coulee-Columbia River	0	0	0	0
1702001101 White River-Little Wenatchee River	23.8	20.4	18.6	16.6
1702001102 Nason Creek	24.4	21.0	16.1	12.8
1702001103 Chiwawa River	29.5	25.4	26.3	22.8
1702001104 Icicle Creek	16.2	11.4	14.8	11.1
1702001105 Peshastin Creek	47.0	35.1	31.1	19.4
1702001106 Mission Creek	16.4	14.1	15.6	13.3
1702001107 Wenatchee River	98.8	62.3	81.5	48.9

1703000101 Cle Elum River	29.5	24.8	23.2	18.6
1703000102 Middle ForkTenaway River-Tenaway River	20.2	18.1	19.1	17.0
1703000103 Kachess River-Yakima River	59.7	51.2	38.7	31.0
1703000104 Wilson Creek-Cherry Creek	4.9	4.1	4.5	3.7
1703000105 Taneum Creek-Yakima River	97.7	70.2	80.3	58.4
1703000106 Wenas River	10.5	8.2	10.5	8.2
1703000201 Little Naches River	69.4	61.0	59.6	51.5
1703000202 Rattlesnake Creek-Naches River	75.3	61.3	69.9	55.8
1703000203 Tieton River-Naches River	82.8	77.2	67.7	62.2
1703000301 Ahtanum Creek	0	0	0	0
1711000504 Three Fools Creek Lightning Creek	0	0	0	0
1711000505 Ruby Creek	15.5	13.7	5.3	3.9
1711000506 Ross Lake-Skagit River	**0**	0	**0**	**0**
Total	1313.2	995.7	1071.5	827.8

*some watersheds with no Designated Open FS System roads not included

The following table shows the miles of road within 300 feet of Critical Fish Habitat that would be open within riparian reserves by alternative.

Table 21 Miles of Road within 300 feet of Critical Habitat (totals shown for context)

Watershed	All Roads adjacent to CHF (FS sys, Unauth, Non-FS) miles	Action Alts Open Roads (FS ML2-5, Non-FS) adjacent to CHF miles	FS Sys Roads (ML 1-5) Adjacent to CHF miles	Action Alts FS Sys Open (ML 2-5) adjacent to CHF miles
1702000209 Myers Creek	0	0	0	0
1702000211 Rock Creek-Kettle River	0	0	0	0
1702000212 Toroda Creek	0	0	0	0
1702000401 Upper Sanpoil River	0	0	0	0
1702000402 West Fork Sanpoil River	0	0	0	0
1702000505 Swamp Creek-Columbia River	0.3	0.3	0	0
1702000615 Inkaneep Creek-Okanogan River	8.1	8.1	0	0
1702000616 Antoine Creek-Okanogan River	5.5	5.5	0	0
1702000617 Bonaparte Creek	3.3	3.3	0	0
1702000618 Tunk Creek-Okanogan River	3.7	3.7	0	0
1702000620 Salmon Creek	12.5	12.5	0	0
1702000621 Scotch Creek-Okanogan River	4.7	4.7	0	0
1702000622 Loup Loup Creek-Okanogan River	5.1	5.1	0	0

1702000701 Pasayten River	0	0	0	0
1702000702 Castle Creek-Similkameen River		0	0	0
1702000713 Headwaters Ashnola River	0	0	0	0
1702000714 Ewart Creek	0	0	0	0
1702000718 Toats Coulee Creek	0	0	0	0
1702000719 Sinlahekin Creek	0	0	0	0
1702000801 Lost River	0.2	0.2		
1702000802 Upper Methow River	6.8	6.7	1.9	1.9
1702000803 Upper Chewuch River	8.0	7.5	8.0	7.5
1702000804 Lower Chewuch River	38.0	35.2	29.2	28.1
1702000805 Twisp River	25.8	22.7	13.3	12.7
1702000806 Middle Methow River	40.3	39.3	5.2	4.6
1702000807 Lower Methow River	45.8	44.5	17.2	16.2
1702000901 Stehekin River	0	0	0	0
1702000902 Upper Lake Chelan	0	0	0	0
1702000903 Lower Lake Chelan	0.3	0.3		
1702001001 Mad River	7.8	7.4	5.6	5.3
1702001002 Entiat River	28.8	28.5	10.8	10.5
1702001003 Lake Entiat-Columbia River	0.4	0.4	0	0
1702001004 Lynch Coulee-Columbia River	0	0	0	0
1702001101 White River-Little Wenatchee River	21.8	20.6	10.0	9.3
1702001102 Nason Creek	17.3	16.4	4.5	4.1
1702001103 Chiwawa River	11.5	10.8	8.3	7.9
1702001104 Icicle Creek	17.4	15.9	10.9	10.4
1702001105 Peshastin Creek	18.4	16.2	4.6	2.4
1702001106 Mission Creek	15.7	15.6	7.6	7.6
1702001107 Wenatchee River	52.0	50.8	6.8	5.6
1703000101 Cle Elum River	15.8	14.7	9.0	8.0
1703000102 Middle ForkTenaway River-Tenaway River	38.3	38.0	20.7	20.4
1703000103 Kachess River-Yakima River	38.5	37.7	9.9	9.3
1703000104 Wilson Creek-Cherry Creek	0	0	0	0
1703000105 Taneum Creek-Yakima River	39.4	37.3	19.3	17.4
1703000106 Wenas River	0	0	0	0
1703000201 Little Naches River	42.5	41.8	32.0	31.4
1703000202 Rattlesnake Creek-Naches River	34.6	34.6	16.0	16.0
1703000203 Tieton River-Naches River	45.5	44.7	23.3	22.5
1703000301 Ahtanum Creek	15.2	15.2		
1711000504 Three Fools Creek-Lightning Creek		0	0	0

1711000505 Ruby Creek	8.0	7.8	0.2	0.1
1711000506 Ross Lake-Skagit River	0	0	0	0
Total	677.4	654.1	274.7	259.5

The following table shows the roads densities by watershed as a result of Alternative A, and the Action Alternatives (B, C, and D).

Table 22 Changes in Designated Open National Forest System Road Density (mi/mi^2) by watershed (totals for context)

Watershed	Alt A Road Density on FS lands (FS system roads and Non-FS Roads) mi/mi^2	Action Alts Open Road Density on FS Lands (FS open roads and Non-FS roads) mi/mi^2	Alt A FS System Road Density on FS lands mi/mi^2	Action Alts FS System Open Roads Density on FS lands mi/mi^2
1702000209 Myers Creek	2.1	1.3	2.0	1.2
1702000211 Rock Creek-Kettle River	0.0	0.0	0.0	0.0
1702000212 Toroda Creek	1.9	1.2	1.8	1.1
1702000401 Upper Sanpoil River	1.8	0.7	1.7	0.6
1702000402 West Fork Sanpoil River	2.7	1.6	2.6	1.5
1702000505 Swamp Creek-Columbia River	2.3	1.7	2.2	1.6
1702000615 Inkaneep Creek-Okanogan River	2.2	1.2	2.1	1.2
1702000616 Antoine Creek-Okanogan River	1.6	0.8	1.5	0.7
1702000617 Bonaparte Creek	2.7	1.8	2.6	1.8
1702000618 Tunk Creek-Okanogan River	2.5	1.0	2.4	0.9
1702000620 Salmon Creek	2.0	1.4	1.9	1.3
1702000621 Scotch Creek-Okanogan River	1.7	1.3	1.4	1.0
1702000622 Loup Loup Creek-Okanogan River	3.9	3.2	3.6	2.9
1702000701 Pasayten River	0.0	0.0	0.0	0.0
1702000702 Castle Creek-Similkameen River	0.0	0.0	0.0	0.0
1702000713 Headwaters Ashnola River	0.0	0.0	0.0	0.0
1702000714 Ewart Creek	0.0	0.0	0.0	0.0
1702000718 Toats Coulee Creek	0.6	0.4	0.5	0.4
1702000719 Sinlahekin Creek	0.2	0.2	0.2	0.2

1702000801 Lost River	0.0	0.0	0.0	0.0
1702000802 Upper Methow River	0.4	0.3	0.3	0.2
1702000803 Upper Chewuch River	0.1	0.1	0.1	0.1
1702000804 Lower Chewuch River	1.8	1.2	1.8	1.2
1702000805 Twisp River	0.9	0.5	0.9	0.5
1702000806 Middle Methow River	2.1	1.4	2.0	1.3
1702000807 Lower Methow River	1.3	0.8	1.3	0.7
1702000901 Stehekin River	0.1	0.1	0.0	0.0
1702000902 Upper Lake Chelan	0.1	0.1	0.1	0.1
1702000903 Lower Lake Chelan	1.4	1.2	1.4	1.2
1702001001 Mad River	3.4	1.6	3.4	1.6
1702001002 Entiat River	2.2	1.2	2.2	1.2
1702001003 Lake Entiat-Columbia River	1.9	1.5	1.7	1.3
1702001004 Lynch Coulee-Columbia River	0.0	0.0	0.0	0.0
1702001101 White River-Little Wenatchee River	0.6	0.5	0.6	0.4
1702001102 Nason Creek	1.3	1.1	0.9	0.7
1702001103 Chiwawa River	1.2	0.9	1.1	0.8
1702001104 Icicle Creek	0.3	0.2	0.3	0.2
1702001105 Peshastin Creek	1.7	1.0	1.4	0.8
1702001106 Mission Creek	0.9	0.6	0.8	0.6
1702001107 Wenatchee River	2.4	1.3	2.2	1.1
1703000101 Cle Elum River	0.9	0.6	0.8	0.5
1703000102 Middle ForkTenaway River-Tenaway River	0.6	0.5	0.6	0.4
1703000103 Kachess River-Yakima River	2.3	1.8	1.8	1.3
1703000104 Wilson Creek-Cherry Creek	1.8	1.3	1.8	1.3
1703000105 Taneum Creek-Yakima River	2.7	2.0	2.5	1.8
1703000106 Wenas River	4.1	3.3	4.0	3.3
1703000201 Little Naches River	1.1	0.8	1.0	0.7
1703000202 Rattlesnake Creek-Naches River	2.2	1.7	2.1	1.6
1703000203 Tieton River-Naches River	1.5	1.3	1.3	1.1
1703000301 Ahtanum Creek	0.9	0.9	0.0	0.0
1711000504 Three Fools Creek-Lightning Creek	0.0	0.0	0.0	0.0

1711000505 Ruby Creek	0.3	0.2	0.2	0.1
1711000506 Ross Lake-Skagit River	0.0	0.0	0.0	0.0
Totals	1.2	0.8	1.1	0.7

Alternative A

Under this alternative, no changes would be made to the current NFTS and no cross-country travel prohibition would be put into place. The Travel Management Rule would not be implemented, and no motor vehicle use map (MVUM) would be produced. Motor vehicle travel by the public would not be limited to designated routes. Unauthorized routes would continue to have no status or authorization as NFTS facilities.

Effects to Threatened, Endangered, Sensitive, and MIS Species

Short-term timeframe: The short term effects to aquatic habitat, including CFH, habitat for sensitive, MIS and EFH are considered the same between alternatives. In a one year time frame little real change to the existing condition is expected as it would take some period for the public to adapt to an alternative that would change current use patterns as well as time for the Forest to inform the public of any changes to the current use and begin to enforce any motorized use changes to a degree that may substantially change use patterns.

Long-term timeframe: Alternative A poses the most risk to T&E, sensitive and MIS species and EFH.[9] Cross country travel along unauthorized routes would continue to increase the potential for sediment and chemical delivery to streams, as well as damage to riparian vegetation and stream banks. The area over which such impacts may occur is expected to increase due to the anticipated increase in unauthorized routes and general cross-country motorized travel, as well as the effects to watershed and aquatic habitats from unauthorized routes. The proliferation of user developed dispersed camp sites is expected to continue resulting in an increasing amount of riparian and aquatic habitat degradation due to: compacting stream adjacent soils; loss of riparian vegetation that may filter sediment before entering streams, provides shade to streams, provides leaf litter that supports the aquatic macroinvertebrate food base for native trout and salmon as well as provide habitat for terrestrial insects that contribute to the food base; and anchor stream banks. There is expected to be continued loss of large woody debris as in-stream wood is cut for campfires and harassment of spawning fish may increase as new dispersed sites are developed. The construction of rock dams by recreationists may also increase inhibiting upstream fish movement during late-summer and fall low flow periods. Most effects to riparian and aquatic habitat are expected to be confined to the site but whether the level of future use under Alternative A would increase to the point of creating or contributing to watershed scale effects is unknown.

Alternative A has the most potential to adversely affect the PCEs for all the ESA listed species and thus contribute to the threats to recovering the T&E fish identified in the recovery plans. Particular threats and impacts to the PCEs due to continued motorized uses, especially open cross country travel include; increased sediment delivery, loss of stream channel complexity and degraded riparian habitat (see Best Available Science and Rationale). While sensitive species and MIS do not have designated critical

[9] Note, EFH overlaps with CFH of MCR steelhead in the Yakima subbasin and CFH for UCR steelhead or UCR spring-run Chinook salmon or bull trout in the Wenatchee, Entiat and Methow subbasins. Therefore the potential impacts to EFH that may be attributed to any alternative will be considered the same as CFH and therefore the potential effects to EFH will not be specifically discussed further.

habitat, MIS and sensitive species habitat would be affected in a similar manner. Depending upon the level of habitat degradation, especially temperature, some non-native MIS may attain a greater competitive advantage over the native MIS if habitat damage contributes to sub-watershed scale effects. The greatest potential for the development of user-built cross country trails and dispersed campsites to impact aquatic habitat would likely occur on the approximately 79,261 acres that have < 40% slope and 50% canopy cover that are open to cross country travel.

Cross Country Motorized Travel

The 2.6 million acres currently open to cross-country motor vehicle travel, including the 675,000 acres most likely being used within this, would still be open. As discussed in the Existing Condition section, cross-country motor vehicle travel frequently results in degradation of riparian vegetation, increased bank erosion, nutrient loading, sedimentation, and hydrocarbon pollution to streams; which in turn increases metabolic rate, respiration crushing, and oxygen demand of fish and amphibians (Jennings 1996). Motor vehicles traveling across stream banks degrade those banks, increase future erosion potential, and deliver sediment to streams, increasing turbidity. These changes result in decreases to water quality that can result in negative impacts to aquatic resources such as fish and aquatic invertebrates.

The Moon and Funny Rock areas would remain open to cross country motor vehicle travel. These

In general, the continuation of off-road travel and the use of unauthorized routes could impact fisheries and aquatic resources in the form of increased erosion and, consequently, increased sediment delivery to watercourses. The creation of new unauthorized routes and the continued use of previously established unauthorized routes near watercourses and riparian areas are of increased concern because many of these routes are user-created and were never designed to effectively move water off of the route. This could lead to the potential for increased amounts of water being captured and diverted into streams. It could also be disruptive to the hydrologic processes that function to provide the high water quality that aquatic species are dependent upon. In addition to negative impacts to water quality, the effects of cross-country motor vehicle travel include opportunities for motorists to cause direct mortality through the crushing of individual aquatic species as they drive through streams and perennial wet areas.

As there are continued disruptions in the aquatic and riparian environment and declines in water quality as unauthorized routes proliferated, aquatic species could be negatively affected. Focused use in areas that are unsuited for cross-country motor vehicle travel is also a concern. Unmanaged motor vehicle use has resulted in unplanned roads, trails, erosion, and watershed degradation. Riparian areas are particularly vulnerable to motor vehicle use. The use of these routes would continue, and new routes could be created. The actual extent to which aquatic biota would be affected as a result of implementing this alternative cannot be quantitatively assessed because of the unknown potential for expansion of the unauthorized route system. The continued unmanaged use of these routes and unlimited cross country travel poses risks to the fish and other aquatic species of the Okanogan-Wenatchee National Forest.

Riparian areas that are of vital importance to aquatic species would continue to be impacted through modifications to vegetation and hydrology that occur with the creation and use of unauthorized routes. Negative impacts to vegetation could result in decreased stream productivity and decreased stream shading. Stream productivity could be reduced when riparian vegetation is modified, reduced, or eliminated. Once riparian vegetation is impacted, it would no longer provide leafy debris or other organic materials to the stream channel. This organic material is consumed by aquatic species including invertebrates, algae, and bacteria as a food source, thus providing a productive and robust aquatic environment supplying food sources for fish. A decrease in stream shading because of modifications or reductions to riparian vegetation will likely contribute to increases in water temperatures through solar insolation. Aquatic species are reliant on natural temperature regimes, and when altered, temperature changes could result in the decreased vigor and production of aquatic populations. Stream temperature is very important to the aquatic communities' diversity and structure. Alterations in environmental conditions like temperature could reduce habitat suitability for some species but increase it for others. The continuation of vehicle travel off designated NFTS roads, and use of unauthorized routes, will likely leave currently disturbed areas unable to reestablish important vegetation and hydrologic function. Current ground disturbances will likely persist, impacting the fisheries and other aquatic resources on the OWNF. In the long-term, this alternative is likely to result in aquatic and riparian habitat degradation and negative impacts to individual fish and other aquatic species individuals. The continued unrestricted creation and use of roads and cross-country travel would have an unquantifiable amount of risk to Forest fisheries and aquatic resources.

Road and Trail Network

Open Road Density

Use of roads can increase the production and delivery of fine, easily detached and eroded soil particles, especially if use exceeds the original road design. Overall, road density would continue to be 1.2 mi/mi^2 on FS lands. Maintenance level 1 roads would continue to be part of this road density because they would not be closed to motorized use. Twenty-three of the 53 watersheds would continue to have open road densities between 1.0 and 2.4 mi/mi^2 while only seven watersheds would have open road densities greater than 2.4 mi/mi^2. Five of the watersheds which are not properly functioning with regard to total road density would have open road densities below 2.4 mi/mi^2. The amount of sediment delivered to the aquatic environment from the roads would vary depending upon the amount of use. Some roads could receive relatively little use and therefore the sediment production may be less than the total road density may suggest.

Functioning Watersheds

There would continue to be 23 watersheds properly functioning, 23 watersheds functioning at risk and seven watersheds that are not properly functioning with regard to road density with implementation of Alternative A. Maintenance Level 1 (ML-1) roads are included in the Road Density on FS Lands calculation because, though these roads are put in a maintenance level that is designed to preclude vehicle use, vehicle use by motorized vehicles is still possible on these roads by virtue of allowing cross-country vehicle travel. These watersheds can be expected to continue experiencing the problems related to moderate and high road densities described in the Existing Condition section. In particular, these watersheds have a greater potential for accelerated erosion and sediment delivery to streams than watersheds with lower road densities, along with resulting impacts to aquatic invertebrates and fish.

Miles of Road in Riparian Reserves/RHCAs

There would be no change in the mileage of roads within RR/RHCAs or the mileage of road in RR/RHCAs. In Alternative A there would be 1,071.5 miles NFS roads in riparian reserves, which includes ML-1 roads. Though ML -1 roads are put in a maintenance level that is designed to preclude vehicle use, vehicle use would still be permitted by virtue of allowing cross-country vehicle travel. The roads within RR/RHCAs would continue to affect floodplain and riparian function through changes to hydrologic function and alteration of vegetation, while being an efficient delivery pathway of sediment to streams. These effects in turn could affect aquatic habitat and organisms by increasing fine sediment in streams and elevating stream temperatures (see Best Available Science and Rationale). These road miles would also have the potential for accelerated erosion dependent on the level of maintenance and use they receive. Current effects to sensitive and MIS species habitat, and EFH would be expected to continue.

Miles of Road within 300 Feet of Critical Fish Habitat

There would be no change in the mileage of roads within 300 feet of Critical Habitat. Overall, there would be approximately 677 miles of roads within 300 feet of Critical Habitat for listed fish species, almost 275 miles of which are Forest Service system road, and about 259 miles of FS System designated open. Much like roads located within the larger RR/RHCAs, the roads within 300 feet of Critical Habitat for Listed Fish would continue to affect floodplain and riparian function through changes to hydrologic function and alteration of vegetation, while being an efficient delivery pathway of sediment to streams. These effects could, in turn, affect aquatic habitat and organisms by increasing fine sediment in streams and elevating stream temperatures (see Best Available Science and Rationale). The current risks to CFH and impacts to the PCEs as well as the recreation threat to bull trout recovery as identified by USFWS (2015) would be expected to continue.

Motorized Access to Dispersed Camping

Unmanaged motorized access for dispersed camping would continue with implementation of Alternative A, perpetuating the current effects described above. Motorized access to dispersed campsites within riparian acres, especially considering that vehicles would be driven to the water's edge, would continue to have a greater potential to affect RR/RHCAs by hydrologic modifications, soil transport and deposition, and vegetation alteration. Concurrent with the potential physical impacts are impacts to aquatic habitat and organisms such as localized decreases in stream shading, and delivery of fine sediment to streams. There would likely be continued proliferation of newly created routes in some areas impacting sensitive, MIS and ESA listed species and CFH. Currently the lack of restrictions on use within 300 feet of critical habitat, including driving and parking motorized vehicles at the water's edge (except at defined sites) would continue to degrade critical fish habitat as described earlier in the sections, Best Available Science and Rationale, and Existing Condition as well as result in the likely proliferation of unauthorized routes in these areas.

Effects Common to Alternatives B, C, and D

Cross Country Motorized Travel

Alternative B, C, or D would be expected to reduce the current and future potential adverse effects to watershed, riparian and aquatic habitat. Closing cross-country travel and designating areas for motorized use would result in a substantial improvement in fish habitat, hydrology, and soil resource conditions. Designating corridors would not only reduce the area where motorized use may occur but improve the ability of the Forest to take enforcement action against unauthorized use. Nearly all threats to aquatic resources from cross-country motor vehicle travel, as described earlier, would be eliminated or at least greatly reduced with the prohibition of cross-country motor vehicle travel on 2.6 million acres of the Okanogan-Wenatchee N.F, about 675,000 of which are relatively low angle, open and accessible enough for cross-country OHV use. Thirty-three acres at the Funny and Moon Rock areas would be designated as open to cross country motor vehicle travel. These areas are located at sites of extrusive volcanic bedrock and have long been used by OHV enthusiast as "rock crawl" challenge areas. Soil development is limited due to the exposed bedrock, and the potential for accelerated erosion and sediment delivery would be limited due to the geomorphic and topographic setting. The cross country use here would have no effect on fish habitat, hydrology, or soil resources.

In areas currently open that would be closed, habitat quality across the Forest is expected to slowly recover in the long-term through passive restoration (freeze/thaw cycles, roots, vegetation regrowth, etc.) as cross-country motor vehicle travel and future motor vehicle route proliferation cease. Important areas with threatened, endangered, or sensitive aquatic species would be further protected from disturbance by the prohibition of cross-country travel. Future risks to water quality would be greatly decreased, as would risks of direct disturbance and other disruptions of the aquatic environment.

It is important to note that previous tables show National Forest System roads and do not show changes as a result of the closure of unauthorized motorized vehicle routes because the Forest does not have an inventory of all unauthorized routes. The cross-country closure would result in a prohibition of use of any unauthorized routes not adopted as an existing route in an alternative, which would eliminate further impacts to soil, water and aquatic species on these routes.

Road Network

Open Road Density and Functioning Watersheds

All action alternatives would result in a decrease in Open Road Density on FS Lands when compared to Alternative A and the Existing Condition, as displayed in Table 22 because all maintenance level 1 roads would be closed to motorized vehicles[10]. This would decrease open road density in 42 watersheds across the forest, and potentially decrease sediment production and delivery to aquatic habitats**.**

Although maintenance level 1 roads would be closed to vehicle use, this would not change the total road density. However, open road density would be 0.4 mi/mi^2 lower in all action alternatives when compared to total road density for an open road density of 0.8 mi/mi^2 on FS lands. While the maintenance level 1 roads will likely continue to impact watershed processes to some degree, the impacts will be reduced if there is no motorized use on the roads. The existing impacts to watershed function, especially accelerated sediment delivery to streams, should decrease as vegetation becomes established on the roads.

Miles of Road within Riparian Reserves/RHCAs

The action alternatives would not change the mileage of roads in RR/RHCAs, but would decrease the mileage of open roads within RR/RHCAs (See Table 20) by closing all maintenance level 1 roads to motorized use. This would decrease the open road miles in RR/RHCAs by 317.5 miles. A total of approximately 995 miles of open roads would be open in riparian reserves, of which almost 828 are FS system roads. There would be a corresponding decrease in effects to RR/RHCAs including sediment delivery as described earlier, and damage to riparian vegetation and aquatic habitat where these roads access streams (see Best Available Science and Rationale). Remaining open roads within RR/RHCAs would continue to affect floodplain and riparian function through changes to hydrologic function and alteration of vegetation, while being an efficient delivery pathway of sediment to streams. These effects in turn can affect aquatic habitat and organisms by increasing fine sediment in streams and elevating stream temperatures (see Best Available Science and Rationale). These road miles would also have the potential to continue causing accelerated erosion dependent on the level of maintenance and use they receive, and the extent to which vegetation becomes established on the roads.
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Miles of roads within 300 feet of Critical Habitat for listed fish species

The action alternatives would not change the mileage of roads within 300 feet of Critical Habitat for listed fish species, but all action alternatives would decrease the mileage of open roads within 300 feet of Critical Habitat for listed fish species by closing ML1 roads (see Table 21).

The Action Alternatives would reduce the open road miles in CHF by 23.3 miles, leaving 654 miles of open roads in riparian reserves, of which 259 would be FS system roads. There would be a corresponding decrease in effects as described earlier to CHF adjacent to those roads, such as reduction in sediment production, improvement of riparian vegetation, etc., which would locally improve conditions for aquatic

[10] Maintenance Level 1 roads would be closed to all motorized vehicles, with the exception of roads included in Forest Service system motorized trails. These limited occurrences were tallied with the motorized trail information in this analysis.

habitat and species. Remaining open roads within CHF would continue to affect floodplain and riparian function through changes to hydrologic function and alteration of vegetation, while being an efficient delivery pathway of sediment to streams. These effects in turn can affect aquatic habitat and organisms by increasing fine sediment in streams and elevating stream temperatures (see Best Available Science and Rationale). These road miles would also have the potential for accelerated erosion dependent on the level of maintenance and use they receive.

Dispersed camping would be allowed at the improved sites for all alternatives. The Forest has implemented actions to contain motor vehicle access to dispersed campsites by either closing areas to dispersed camping or defining and limiting motorized access to some locations. Restoration efforts along access routes and within campsites have included soil de-compaction and stream bank plantings. Rock or wood barriers have been installed to limit the size and area of disturbance at the sites, and to limit motorized vehicle access within riparian areas as described in the Existing Condition. While these efforts have been largely effective at reducing impacts at some locations, continued use, and increases in the size and number of sites in other areas could perpetuate impacts to riparian areas and aquatic habitat. The effects to aquatic and riparian habitat at the improved sites is expected to continue although over the long term should be reduced from the existing condition as recreationists adjust use to the new rules and the Forest is better able to take enforcement action against users camping outside the boundaries of the improved sites.

Effects of Limitations on Motorized Access for Dispersed Camping in Alternatives B, C, and D

Alternatives B, C, and D would all limit motorized access to dispersed camping by designating specific corridors, and restricting the use of motorized vehicles within the corridors to existing access routes, and other than at the improved sites, prohibiting vehicles within 100 feet of lakesides, riversides, and creek sides. This would prohibit the proliferation of new access routes, and reduce impacts to fish habitat, although violations of the rule would likely occur, especially in the first several years following publication of the MVUM, when people are learning the rules. Keeping vehicles at least 100 feet from water would reduce damage to riparian vegetation, and decrease erosion into the water from bank erosion and soil displacement. Riparian areas would be further protected by requiring the use of existing access routes. There would be no additional loss of vegetation or damage to soil since new access routes would be prohibited. As stated earlier, violations of this would likely occur, especially in the first few years after publication of the MVUM. It’s assumed that the frequency of violations would be low, based on overall violation use data. The location of any potential violation cannot be estimated, therefore, the environmental effects of violations are not analyzed or projected.

Dispersed camping would be allowed at the improved sites for Alternatives B, C, and D. The Forest has implemented actions to contain motor vehicle access to dispersed campsites by either closing areas to dispersed camping or defining and limiting motorized access to some locations. Restoration efforts along access routes and within campsites have included soil de-compaction and stream bank plantings. Rock or wood barriers have been installed to limit the size and area of disturbance at the sites, and to limit motorized vehicle access within riparian areas as described in the in the Existing Condition. While these efforts have been largely effective at reducing impacts at some location, continued use and increases in the size and number of sites in other areas could perpetuate impacts to riparian areas and aquatic habitat. The effects to aquatic and riparian habitat at the improved sites is expected to continue although over the long term should be reduced from the existing condition as recreationists adjust to the new rules and the Forest is better able to take enforcement action against users camping outside the boundaries of the improved sties.

The number of acres of riparian reserves/RHCAs within corridors, and within 300 feet of CFH would vary by alternative, as shown in Table 23. The effects of these variations are discussed in the alternative-specific sections below.

Table 23--Acres of Designated Camping Corridor within RR/RHCAs and as a percentage of Total RR/RHCA acres, and Within 300 Feet of Critical Fish Habitat

	Alternative B	Alternative C	Alternative D
Within RR/RRHCAs			
Acres	20,457	14,401	53,744
Percentage of Total RR/RHCA acres	4	3	11
Approximate number of established access routes within corridors	227	100	301
Within 300 Feet of Critical Fish Habitat			
Acres	5,042	0	15,175
Approximate number of established access routes within corridors	107	0	141

Effects of Monitoring and Mitigation Strategy for Corridors

Monitoring and Mitigation would be conducted to determine the effects of motorized access to dispersed camping and corridor designation, and to ensure compliance with the ACS and RMOs. The overall ACS and RMO objectives are to maintain or improve processes and functions necessary for healthy aquatic ecosystems at the watershed scale. The Monitoring and Mitigation Plan includes implementation and effectiveness monitoring as well as specific actions to be taken that depend on the results of monitoring. Implementation monitoring would determine how well travel management decisions have been implemented and effectiveness monitoring would determine how effective implementation of the MVUM has been in accomplishing the desired outcome with regards to routes to dispersed camping and corridors. Corridors designated for motorized access to dispersed camping would be monitored according to priority determined by their proximity to aquatic and watershed values. If monitoring results in the identification of impacts that approach or exceed ACS or RMO standards, actions would be implemented to return sites to conditions that are within standards.

Mitigation actions that would take place depending on monitoring results:

- using boulders, fences, or other barriers to keep vehicles to an acceptable location;
- hardening the access route surface to minimize erosion;
- improving the access routes with water bars or other drainage structures to protect water quality; or
- decommissioning and blocking the access route.

Due to the combined actions of monitoring and mitigation, the potential for the sites to increase sediment production and delivery to aquatic systems would be reduced.

Alternative B

Acres of Riparian Reserves or RHCAs designated as Corridors.

Alternative B would have 20,457acres of Riparian Reserves/RHCAs within corridors, and approximately 227 established access routes. Motorized vehicle use within these corridors would continue the potential for sediment production and sediment delivery to stream networks resulting from soil and vegetation impacts as described in Best Available Science and Rationale. However, the large reduction of RR/RHCA acreage available to cross-country motorized travel and requirements listed design criteria for corridors (vehicles confined to existing routes) and the Monitoring and Mitigation Plan (see effects common to all) would greatly reduce the potential for sediment production and sediment delivery to aquatic systems when compared to the current condition. Consequently, the potential for impacts to aquatic habitat and organism resulting from incremental increases in impacted areas and route proliferation in corridors within RRs/RHCAs projected to occur with Alt. A, would no longer occur (see **Error! Reference source not found.**).

Acres of Riparian Reserves within 300 feet of Critical Fish Habitat designated as Corridors. Similarly, Alternative B would have approximately 5,042 acres of corridor within 300 feet of critical habitat for listed fish species, and approximately 107 established access routes. These acres would have a continuing potential for sediment production and sediment delivery to stream networks resulting from soil and vegetation impacts as described earlier. However, there would be a large reduction in the number of acres of Critical Fish Habitat within corridors compared to Alternative A. Limiting motorized vehicle use within the corridors to established routes and not allowing dispersed camping within 100 feet of water, with the corresponding monitoring and mitigation would greatly reduce the potential for sediment production and sediment delivery to aquatic systems when compared to the current condition. Consequently, the potential for impacts to aquatic habitat and organisms resulting from incremental increases in impacted areas and route proliferation in corridors within RRs/RHCAs projected to occur with Alt. A, would be greatly reduced over time.

Table 24 . Acres of RR/RHCA within 300 feet of Critical Habitat within Alternative B Corridors (acres are greater than total CFH because CFH is designated for multiple species on the same stream)

Watershed	UCR Spring Chinook/Difference	UCR Steelhead/Difference	Bull Trout/Difference	MCR Steelhead/Difference
1702000801 Lost River	0	0	0	0
1702000802 Upper Methow River	41	5	45	0
1702000803 Upper Chewuch River	104	104	104	0
1702000804 Lower Chewuch River	717	668	1,232	0
1702000805 Twisp River	25	131	263	0
1702000806 Middle Methow River	0	10	115	0
1702000807 Lower Methow River	0	248	186	0
1702001001 Mad River	152	152	175	0
1702001002 Entiat River	86	110	0	0
1702001101 White River-Little Wenatchee River	60	60	394	0
1702001102 Nason Creek	33	44	32/	0

1702001103 Chiwawa River	19	45	28	0
1702001104 Icicle Creek	0	15	15	0
1702001105 Peshastin Creek	0	37	10	0
1702001106 Mission Creek	0	14	0	0
1702001107 Wenatchee River	21	77	10	0
1703000101 Cle Elum River	0	0	320	0
1703000102 Middle ForkTenaway River-Tenaway River	0	0	301	347
1703000103 Kachess River-Yakima River	0	0	67	35
1703000105 Taneum Creek-Yakima River	0	0	134	164
1703000201 Little Naches River	0	0	237	239
1703000202 Rattlesnake Creek-Naches River	0	0	53	266
1703000203 Tieton River-Naches River	0	0	424	68

Alternative C

Acres of Riparian Reserves or RHCAs designated as Corridors.
Under Alternative C there would be no corridors within RRs/RHCAs adjacent to CFH resulting in 14,401 acres (three percent of the RRs/RHCAs on the Forest) of designated corridors within RR/RHCAs. There would be approximately 100 established access routes within these corridors where continued motorized use would be allowed. Consequently, this alternative would result in the largest reduction in the potential for sediment production and delivery to aquatic systems when compared all alternatives.

Acres of Riparian Reserves or RHCAs within 300 feet of CH designated as Corridors.
There would be no riparian reserves or RHCAs within 300 feet of CFH included in corridors with implementation of Alternative C, and therefore no established access routes where motorized use would be allowed. This would result in the largest reduction in the potential for sediment production and delivery to aquatic systems when compared to all other alternatives.

Alternative D

Acres in Riparian Reserves or RHCA's designated as Corridors.
Alternative D would designate 53,744 acres (44 percent) of RRs/RHCAs within corridors, and allow the continued use of the approximate 301 established access routes. Although this alternative would establish corridors on all open roads[11], the motor vehicle limitations would reduce impacts, compared to Alternative A. Motor vehicles would be restricted to not traveling over 300 feet from the center line of open roads, using only existing access routes, and would not be allowed closer than 100 feet to water other than at improved sites. The potential for sediment production and sediment delivery to stream networks resulting from soil and vegetation impacts is expected to be greater than either Alternatives B or C but less than may be expected under Alternative A since maintenance level 1 roads would be closed. The Monitoring and Mitigation plan for corridors would reduce the potential for sediment production and sediment delivery to aquatic systems when compared to the current condition because currently these areas are open without restrictions on use.

Table 25 Acreage of RR/RHCAs and CHF within Alternative D Corridors

Watershed	Acres within Alternative D Corridors within RR/RHCA	Acres within Alternative D Corridors 300 feet of open roads adjacent to CFH
1702000209 Myers Creek	228.8	0
1702000211 Rock Creek-Kettle River	0	0
1702000212 Toroda Creek	853.3	0
1702000401 Upper Sanpoil River	152.3	0
1702000402 West Fork Sanpoil River	1278.2	0
1702000505 Swamp Creek-Columbia River	288.7	0
1702000615 Inkaneep Creek-Okanogan River	126.5	0
1702000616 Antoine Creek-Okanogan River	113.9	0
1702000617 Bonaparte Creek	298.0	0
1702000618 Tunk Creek-Okanogan River	47.5	0
1702000620 Salmon Creek	1358.3	0
1702000621 Scotch Creek-Okanogan River	20.8	0
1702000622 Loup Loup	95.6	0

[11] Alternative A does not include any corridors since people would be able to continue driving motorized vehicles off all open roads to access dispersed campsites. Refer to the Alternative A discussion for complete discussion and information.

Creek-Okanogan River		
1702000701 Pasayten River	0.2	0
1702000702 Castle Creek-Similkameen River	0	0
1702000713 Headwaters Ashnola River	0	0
1702000714 Ewart Creek	0	0
1702000718 Toats Coulee Creek	146.0	0
1702000719 Sinlahekin Creek	2.1	0
1702000801 Lost River	28.1	1.5
1702000802 Upper Methow River	474.2	151.2
1702000803 Upper Chewuch River	749.4	484.2
1702000804 Lower Chewuch River	4424.6	1623.5
1702000805 Twisp River	1908.1	897.6
1702000806 Middle Methow River	3065.6	297.6
1702000807 Lower Methow River	2043.0	690.1
1702000901 Stehekin River	14.1	0
1702000902 Upper Lake Chelan	332.1	0
1702000903 Lower Lake Chelan	770.9	0
1702001001 Mad River	961.5	336.4
1702001002 Entiat River	2281.6	677.4
1702001003 Lake Entiat-Columbia River	1983.9	0
1702001004 Lynch Coulee-Columbia River	0	0
1702001101 White River-Little Wenatchee River	1258.0	638.5
1702001102 Nason Creek	952.3	201.5
1702001103 Chiwawa River	1575.3	534.9
1702001104 Icicle Creek	728.6	481.5
1702001105 Peshastin Creek	1091.6	157.3
1702001106 Mission Creek	808.9	466.3
1702001107 Wenatchee River	2732.7	243.2
1703000101 Cle Elum River	1365.6	577.0
1703000102 Middle ForkTenaway River-Tenaway River	1032.5	811.5

1703000103 Kachess River-Yakima River	2271.1	622.6
1703000104 Wilson Creek-Cherry Creek	297.7	0
1703000105 Taneum Creek-Yakima River	3465.4	896.4
1703000106 Wenas River	467.1	0
1703000201 Little Naches River	3544.3	1937.2
1703000202 Rattlesnake Creek-Naches River	3657.8	998.7
1703000203 Tieton River-Naches River	4148.3	1431.4
1703000301 Ahtanum Creek	0	0
1711000504 Three Fools Creek-Lightning Creek	0	0
1711000505 Ruby Creek	299.8	17.5
1711000506 Ross Lake-Skagit River	0	0
Total	53744.3	15175.1

Table 26 Acreage of CFH RR/RHCAs within Alternative D Corridors (note acres are greater than the total CFH acres because CFH is often designated for multiple species within the same stream)

Watershed	UCR Spring Chinook	UCR Steelhead	Bull Trout	MCR Steelhead
1702000801 Lost River	1.5	1.5	1	0
1702000802 Upper Methow River	122	48	141	0
1702000803 Upper Chewuch River	470	470	443	0
1702000804 Lower Chewuch River	785	746	1,485	0
1702000805 Twisp River	428	665	826	0
1702000806 Middle Methow River	41	63	290	0
1702000807 Lower Methow River	0	398	520	0
1702001001 Mad River	282	282	282	0
1702001002 Entiat River	388	561	245	0
1702001101 White River-Little Wenatchee River	131	131	527	0
1702001102 Nason Creek	113	190	170	0
1702001103 Chiwawa River	431	449	460	0

1702001104 Icicle Creek	0	449	445	0
1702001105 Peshastin Creek	0	87	90	0
1702001106 Mission Creek	0	466	0	0
1702001107 Wenatchee River	128	239	114	0
1703000101 Cle Elum River	0	0	580	9
1703000102 Middle Fork Tenaway River-Tenaway River	0	0	656	608
1703000103 Kachess River-Yakima River	0	0	542	185
1703000105 Taneum Creek-Yakima River	0	0	437	850
1703000201 Little Naches River	0	0	1624	1506
1703000202 Rattlesnake Creek-Naches River	0	0	483	771
1703000203 Tieton River-Naches River	0	0	1339	387

There would be 15, 071 acres of 5^{th} level HU designated as Corridors under this alternative, with motorized use allowed on the approximate 301 established access routes. As described above, the motor vehicle limitations would reduce impacts, compared to Alternative A. Motor vehicles would be restricted to using only existing access routes, and would not be allowed closer than 100 feet to water. The areas would have a continuing potential for sediment production and sediment delivery to stream networks resulting from soil and vegetation impacts. However, due to the Monitoring and Mitigation Plan the potential for impacts to aquatic habitat and organisms resulting from incremental increases in impacted areas and route proliferation in corridors within Critical Habitat would not occur, recognizing successful implementation of the Monitoring and Implementation Plan may be more difficult with more areas included in motorized access corridors than in Alternatives B and C.

Acres of Riparian Reserves or RHCAs within 300 feet of CH designated as Corridors.
There would be 15,175 riparian reserves or RHCAs within 300 feet of CFH included in corridors with implementation of Alternative D, and 141 established access routes where motorized use would be allowed within 300 feet of CFH. This would result in the some reduction in the potential for sediment production and delivery to aquatic systems when compared to existing condition due to the prohibition of cross country travel and the Forest's ability to enforce travel management rules within the corridors..

Effects of WATV Routes in Alternative B and D

Under Alternatives B and D, 350 miles of currently open Forest Service system roads will be open to WVAT (need the spelling out). Since these are currently open roads the effects of adding the new use are expected to be minor except for potentially an increased risk of off road travel where these vehicles will now be allowed depending upon the alternative.

Overall effects of Alternative B on Soil, Water and Aquatic Resources

Short-term timeframe: The short term effects to aquatic habitat, including CFH, habitat for sensitive, MIS and EFH are considered the same between alternatives. In a one year time frame little real change to the existing condition is expected as it would take some period for the public to adapt to an alternative that would change current use patterns as well as time for the Forest to inform the public of any changes to the current use and begin to enforce any motorized use changes to a degree that may substantially change use patterns.

Long-term timeframe: Actions listed above which may result in modest short term decreases in sediment production and delivery would likely lead to greater long term reductions due to natural re-vegetation of roads that are currently open and would be closed under this alternative. By designating the Forest closed to motor vehicle travel except on designated routes, undesignated routes and roads would not produce easily detached and eroded soil particle through time. Further, re-vegetation through time would reduce sediment production and delivery, particularly in RR/RHCAs where transport distances are the shortest.

As mentioned, designation of corridors includes special provisions for operation of motor vehicles within the corridors, which are designed to prevent incremental growth of disturbed areas within the corridors. The monitoring and mitigation, as discussed above, would also identify and mitigate for incremental growth. These measures would reduce the chronic production and delivery of sediment within the RR/RHCAs as well as protect riparian vegetation necessary for maintenance of beneficial microclimates and stream temperature. The provisions and strategies would also serve to maintain streambank integrity and shade which is essential to the maintenance of optimum water temperature and aquatic habitat (See Best Available Science and Rationale).

Decreasing the production and delivery of fine sediment to aquatic systems would be beneficial to these systems. Decreasing sediment may improve spawning success, improve primary production of aquatic microorganisms and insects, and improve respiration and feeding success of salmonids (See Best Available Science and Rationale)

Effects to Threatened, Endangered, Sensitive, and MIS Species

Alternative B reduces the risk to T&E, MIS and sensitive species and their habitat compared to Alt. A. Cross country motorized use, including the use of maintenance level 1 roads outside of designated corridors would no longer be allowed, greatly reducing the potential for sediment and chemical delivery to streams, damage to stream banks and riparian vegetation from such use. Motorized use would be authorized only within designated corridors along existing roads, trails and routes within the designated corridors, and not within 100 feet of water. Motorized access under Alternative B would be restricted to four percent of the RRs/RHCA acreage on the Forest. Not allowing motorized use within 100 feet of streams and other waterbodies would protect riparian and aquatic habitat function from damage by motor vehicles as riparian vegetation that filters sediment, provides shade and bank stability to streams, as well as leaf litter and terrestrial invertebrates should be maintained.

The potential impacts to riparian and aquatic habitat due to dispersed camping would also be greatly reduced as access to dispersed sites would be confined to existing routes within the corridors, and, other than the improved sites, there would be no motorized use in the corridors within 100 feet of a stream other than at the improved sites. By keeping motorized use back 100 feet, the potential damage to riparian soils, vegetation, and stream banks would be greatly reduced, since any impacts would be caused by foot traffic and not by vehicles. There would undoubtedly be unauthorized cross-country travel but such travel should diminish over time as the public adjusts their use patterns to conform to the new rules. Having designated corridors would make it easier for the Forest to manage motorized use to prevent impacts to watershed, riparian and aquatic resources and designated corridors will allow for better enforcement of unauthorized motorized use and allow the Forest to focus monitoring within the corridors.

The potential for motorized use to affect the PCEs of CFH and contribute to the threats to recovery of ESA listed fish would be greatly reduced in all watersheds with CFH, as the acres within RRs/RHCAs adjacent to CFH open to motorized use greatly reduce in all watersheds (**Error! Reference source not found.**). The reduced acres of RRs/RHCAs not only in watersheds with CFH but other watersheds as well also greatly reduces the potential for adverse effects to MIS and sensitive species.

Overall effects of Alternative C on Soil, Water and Aquatic Resources

Short-term timeframe: The short term effects to aquatic habitat, including CFH, habitat for sensitive, MIS and EFH are considered the same between alternatives. In a one year time frame little real change to the existing condition is expected as it would take some period for the public to adapt to an alternative that would change current use patterns as well as time for the Forest to inform the public of any changes to the current use and begin to enforce any motorized use changes to a degree that may substantially change use patterns.

Long-term timeframe: Alternative C would decrease open road densities in forty-two watersheds. While the road mileage in RR/RHCAs would not change, there would be 317.5 fewer miles of road open to vehicle travel in RR/RHCAs, and 23.3 fewer miles of open road to vehicle travel in critical fish habitat as a result of closing maintenance level 1 roads to motorized vehicles. Since use of routes continuously produces fine, easily detached and eroded soil particles, closure would reduce sediment production.

Alternative C would have the least potential impact to RR/RHCA of any alternative. The RR/RHCAs not included in corridors would be restored as the access routes revegetate, and no new ones are established. The special provisions for operation of motor vehicles within the corridors would help reduce the risk of incremental growth of disturbed areas within the corridors. The monitoring and mitigation, as discussed above, would also identify and mitigate for incremental growth. These measures would reduce the chronic production and delivery of sediment within the RR/RHCAs as well as protect riparian vegetation necessary for maintenance of beneficial microclimates and stream temperature. The provisions and strategies would also serve to maintain streambank integrity and shade which is essential to the maintenance of optimum water temperature and aquatic habitat (See Best Available Science and Rationale).

Short term there would be a slight reduction in delivery of sediment to water ways. Riparian vegetation would benefit in the short term primarily due to further decreases in the acreage of RR/RHCA where vehicle travel would be permitted and the Monitoring and Mitigation Plan discussed above in Effects Common to All Action Alternatives.

Alternative C would reduce motor vehicle travel in sensitive riparian areas. Because of the decrease in the number of established access routes where motorized use would be allowed within RR/RHCA riparian vegetation would improve as those areas begin to recover naturally. By designating the Forest closed to motor vehicle travel except on designated routes and roads, undesignated routes and roads would not produce easily detached and eroded soil particles through time. Further, re-vegetation through time would reduce sediment production and delivery, particularly in RR/RHCAs where transport distances are the shortest.

As mentioned, this alternative would have the least number of acres in corridors, and the fewest number of established access routes where motorized vehicles would still be allowed. This would result in the largest reduction in the chronic production and delivery of sediment within the RR/RHCAs as well as protect riparian vegetation necessary for maintenance of beneficial microclimates and stream temperature, compared to the other alternatives. The design criteria for corridors as well as the Monitoring and Mitigation Plan would also serve to maintain streambank integrity and shade which is essential to the maintenance of optimum water temperature and aquatic habitat.

Over time, this alternative would allow for a very high level of recovery in the RRs and RHCAs currently impacted by cross-country motor vehicle use and the use of unauthorized routes. Passive natural restoration of previously created unauthorized routes would begin to improve riparian conditions beginning in the first couple of years, while longer term, five or more years, would likely show near complete recovery in some areas. The rate that passive restoration would improve conditions would be directly proportional to the degree of current impacts in any particular area. The degree of compaction provides a good example of one characteristic that would influence restoration and recovery rates. The higher the degree of compaction in an area the longer it may take to recover. As passive restoration occurs across the landscape improved conditions are expected for fish and aquatic species.

Decreasing the production and delivery of fine sediment to aquatic systems would be beneficial to these systems. Decreasing sediment may improve spawning success, improve primary production of aquatic microorganisms and insects, and decrease the potential harassment of spawning salmon and bull trout. (Best Available Science and Rationale)

Effects to Threatened, Endangered, Sensitive, and MIS Species

Alternative C poses the least risk and would provide the most benefit to T&E, MIS and sensitive species and their habitat of all alternatives. Cross country motorized use, including the use of maintenance level 1 roads outside of designated corridors would no longer be allowed, greatly reducing the potential for sediment and chemical delivery to streams, damage to stream banks and riparian vegetation from such use. Motorized use would be authorized only within designated corridors along existing roads, trails and routes within the designated corridors, and not within 100 feet of water. Motorized access under Alternative C would be restricted to three percent of the RRs/RHCA acreage on the Forest. Not allowing motorized use within 100 feet of streams and other waterbodies would protect riparian and aquatic habitat function from damage by motor vehicles as riparian vegetation that filters sediment, provides shade and bank stability to streams, as well as leaf litter and terrestrial invertebrates should be maintained.

The potential impacts to riparian and aquatic habitat due to dispersed camping would also be greatly reduced as access to dispersed sites would be confined to existing routes within the corridors, and other than the improved sites, there would be no motorized use in the corridors within 100 feet of a stream. By keeping motorized use back 100 feet, the potential damage to riparian soils, vegetation, and stream banks would be greatly reduced to that caused by foot traffic and not by vehicles. There would undoubtedly be unauthorized cross-country travel but such travel should diminish over time as the public adjusts their use patterns to conform to the new rules. Having designated corridors would make it easier for the Forest to manage motorized use to prevent impacts to watershed, riparian and aquatic resources and designated corridors would allow for better enforcement of unauthorized motorized use and allow the Forest to focus monitoring within the corridors.

Alternative C should not affect the PCEs of CFH or contribute to the threats to recovery of ESA listed fish. There would be no corridors open to motorized use within RRs/RHCAs adjacent to CFH, other than at the improved sites. Allowing no motorized access in RRs/RHCAs adjacent to CFH would also protect habitat for MIS and sensitive species habitat within those areas.

Overall Effects of Alternative D on Soil, Water and Aquatic Resources

Short-term Timeframe: The short term effects to aquatic habitat, including CFH, habitat for sensitive, MIS and EFH are considered the same between alternatives. In a one year time frame little real change to the existing condition is expected as it would take some period for the public to adapt to an alternative that would change current use patterns as well as time for the Forest to inform the public of any changes to the current use and begin to enforce any motorized use changes to a degree that may substantially change use patterns.

Long-term Timeframe: Open road densities will be reduced in forty-two watersheds resulting in approximately 317 fewer miles of open roads in RR/RHCAs and 23 fewer miles of open road within RRs/RHCAs adjacent to CFH. The reduction in open road densities is expected to decrease in sediment production and delivery especially over time due to natural re-vegetation of roads and unauthorized routes that are currently open or being used. By designating the Forest closed to motor vehicle travel except on designated route and roads, undesignated routes and roads would not produce easily detached and eroded soil particles through time. The benefits of reduced sediment production and delivery through time will be greatest as in RR/RHCAs where transport distances are the shortest.

As mentioned, designation of corridors would include special provisions for operation of motor vehicles within the corridors, which would be designed to prevent incremental growth of disturbed areas within the corridors. Monitoring and Mitigation Plan strategies would also identify and mitigate for incremental growth (See Effects Common to All Action Alternatives). These measures would reduce the chronic production and delivery of sediment within the RR/RHCAs as well as protect riparian vegetation necessary for maintenance of beneficial microclimates and stream temperature. The provisions and strategies would also serve to maintain streambank integrity and shade which is essential to the maintenance of optimum water temperature and aquatic habitat (See Best Available Science and Rationale).

Decreasing the production and delivery of fine sediment to aquatic systems would be beneficial to these systems. Decreasing sediment may improve spawning success, improve primary production of aquatic microorganisms and insects. The potential for harassment of spawning salmon and bull trout should be reduced from the present as vehicles will not be allowed within 100 feet of water except at the improved sites. (See Best Available Science and Rationale).

Effects to Threatened, Endangered, Sensitive, and MIS Species

Implementation of Alternative D would result in less disruption of watershed processes, riparian and aquatic habitat than continued management as described for Alternative A but is not as protective as Alternatives B and C. As in Alternatives B and C the risks to T&E, MIS and sensitive species and their habitat, compared to the current situation, would be reduced as cross country motorized use, including the use of maintenance level 1 roads would no longer be allowed. Restricting motorized vehicles to only maintenance level 2 through 5 roads, motorized trails and established routes to dispersed campsites would reduce the potential for sediment and chemical delivery to streams, and reduce damage to stream banks and riparian vegetation compared to the existing condition and Alternative A. Motorized use would be authorized only along established access routes within 300 feet of existing roads maintenance level 2-5 roads and not within 100 feet of water except at the improved sites. Motorized access under Alternative D would be restricted to the established access routes that fall within four percent of the RRs/RHCA acreage on the Forest. Not allowing motorized use within 100 feet of streams and other waterbodies would protect riparian and aquatic habitat function from damage by motor vehicles as riparian vegetation that filters sediment, provides shade and bank stability to streams, as well as leaf litter and terrestrial invertebrates should be maintained.

The potential impacts to riparian and aquatic habitat due to dispersed camping would also be greatly reduced as access to dispersed sites would be confined to existing routes within the corridors, and other than the improved sites, there is no motorized use in the corridors within 100 feet of a stream. By keeping motorized use back 100 feet the potential damage to riparian soils, vegetation, and stream banks is greatly reduced to that caused by foot traffic and not by vehicles. There would undoubtedly be unauthorized cross-country travel but such travel should diminish over time as the public adjusts their use patterns to conform to the new rules. As with the other action alternatives, having designated corridors would make it easier for the Forest to manage motorized use to prevent impacts to watershed, riparian and aquatic resources and designated corridors will allow for better enforcement of unauthorized motorized use and allow the Forest to focus monitoring within the corridors.

The potential for motorized use to affect the PCEs of CFH and contribute to the threats to recovery of ESA listed fish, as well as adversely affect habitat for MIS and sensitive species, is reduced compared to Alternative A, but is greater than Alternatives B and C. With Designated Corridors along all open roads, the potential for unauthorized cross country travel and unauthorized travel and dispersed camping within 100 feet of streams is greater than Alternative B and C due to the increased area the Forest would need to monitor and potentially implement mitigation measures.

4.2 Cumulative Effects

Analysis Area & Boundary Rationale -The 5th level HUCs partially or wholly within the Forest boundary. Cumulative effects can sometimes be observed lower in the watershed as non-point water quality problems such as elevated temperatures or turbidity. The temporal boundary for the analysis begins with the construction of dams on the Columbia River that affected fish migration upstream in 1930's, until the 2020's.

Past

Effects of dam construction, over-harvest of fish and other human activities on the landscape (including timber harvest, off-road travel, flow management, mining, fish stocking and domestic livestock grazing) have contributed to reduced aquatic habitat quality and aquatic biota population levels currently present across the OWNF resulting in the current condition as described in the affected environment section and under Alternative A of this document.

Ongoing (Present), and Reasonably Foreseeable Future Actions

Actions that are planned in and around the Okanogan-Wenatchee National Forest that may act cumulatively to affect water and fisheries displayed in Table 3.0-1, with more detailed information in Appendix A of the Draft Environmental Assessment (EA),. A generalized discussion of the potential effects of those actions is displayed in Table 27 below.

Table 27 Actions Planned on and adjacent to the Okanogan-Wenatchee National Forest

Project type	Negative or Beneficial effect	Possible effect to Soil, Fisheries and Water
Restoration - vegetation Management ,commercial harvest, thinning, fuels reduction projects	Both	Yarding systems and harvest locations have the potential to increase sediment production and delivery when employed in RR, may affect aquatic systems and habitat. Reduction of uncharacteristic, high severity fire risk through thinning and fuels reduction may reduce sediment production and delivery risk to aquatic systems.
Restoration - road, trail and motorized area construction, reconstruction and use	Negative	Use of roads and creation of new or temporary roads potentially increases sediment production and delivery to aquatic systems. Potentially decreases riparian vegetation depending on location and negatively effects hydrologic regimes. May degrade aquatic systems and habitat.
Restoration - Road and trail decommissioning and closures	Beneficial	Reduces potential sources for sediment production and delivery. Reduce potential for locally altering hydrology. Potentially improves riparian vegetation and sediment regime in aquatic systems leading to improved aquatic habitats.
Transportation System Management	Beneficial	Long term reduction in open road mileage across the Forest would reduce potential sources of sediment production and local hydrologic alterations. Potentially improves riparian vegetation and sediment regime in aquatic systems leading to improved aquatic habitats
Fuels Reduction/Management	Beneficial	Reduction of fuel loading has the potential to avert or reduce high intensity fires that can have a short term impact to sediment and hydrology regimes, as well as affect riparian and aquatic habitat.
Aquatic Habitat Restoration	Beneficial	Projects designed to improve aquatic habitat and reduce impacts to aquatic habitat from legacy management activities.
Road Maintenance/Management	Beneficial	Through identification and remediation of problem areas or sites, maintenance has the potential to reduce impacts to aquatic habitat and hydrologic systems.
Special Use Permits	Both	The vast majority of special uses have little to no effect on aquatic systems (e.g. repeater sites). Some Special Uses do have the potential to affect aquatic systems (e.g. transmission line permits). It is assumed that those projects would have permit conditions in place to minimize effects to aquatic systems and aquatic dependent species.

Grazing	Negative	Potential for reduction in riparian vegetation and increase in stream temperature. Potential for increasing streambank erosion and sediment delivery to aquatic systems. The potential negative effects may be reduced through the allotment management planning process and range administration.
Minerals	Negative	May directly affect streambeds and aquatic systems in the case of placer mining. Potential impacts to riparian vegetation and increases in sediment production and delivery.
Weed treatments	Beneficial	Reduces non-native species which typically provide less ground cover than natives, resulting in higher erosion and sediment delivery rates. Non-Natives can outcompete natives in RR.

Restoration projects, transportation system management, fuels reduction/management, aquatic habitat restoration, road maintenance and management, invasive species control, special use permits, minerals projects, recreation projects, facilities, or communication site projects could have effects that would mitigate or add to the effects of this action.

Typically, with these types of projects, there are a suite of effects to watershed processes, fish and aquatic biota. The effects are dependent on the design criteria of the projects and can be minimal or extensive. Ground-disturbing activities such as timber sales, mining and road building can displace sediments, which can be delivered to waterways and affect aquatic biota. Mining and minerals projects have the potential to affect water quality with increases in turbidity. Grazing allotments can contribute to destabilization of banks and result in increases in turbidity as well. Most of these impacts can be mitigated or prevented, dependent on project design criteria.

Some of these actions, particularly restoration projects with a vegetation management component, have the potential to temporarily increase road density. Temporary roads are often constructed to harvest timber resources. Temporary roads are to be used only during the period of harvest and would not be open to public motor vehicle use, however they still function as road and have the resource effects listed in sec 2.2 until they are decommissioned or put into long term storage and passively restored. Present and reasonably foreseeable road management actions include decommissioning and closing of NFTS roads. The primary effects of increases in road density are related to increased risk to water quality parameters such as sediment production and temperature. Road management projects that decommission or close roads would decrease sediment levels and improve fish habitat over the long term.

There are currently 10,506 road/stream crossing, 7,150 FS system road crossings, and 709 motorized trail crossings on the Forest. Since none of the alternatives would decommission any roads, the number of crossings would not change with the implementation of any alternative. These crossings may contribute sediment directly to streams, and in some cases increase the potential for contributing chemical contaminants, including petrochemicals. There are approximately 183 miles of motorized trails within RR and RHCAs and 709 motorized trail-stream crossings Table 16. The location of these trails within RR/RHCAs and their proximity to watercourses increases the potential for these trails to deliver sediment to the stream network. None of the alternatives would change the existing motorized system trails, so the effects of motorized use on the existing trails will continue as described in the Existing Condition and Best Available Science and Rationale sections.

The Forest is proposing to close or decommission approximately 218.5 miles of road as part of reasonably foreseeable future restoration projects, and another 169.7 miles of road in a transportation system plan across the forest. These actions would likely further reduce sediment production and delivery to streams and would have a positive effect on fish and aquatic species.

Under all alternatives the Forest will continue management actions to minimize or avoid adverse effects to riparian and aquatic resources at the improved sites. Typical actions at these sites include restoration efforts along access routes and within campsites such as soil de-compaction and stream bank plantings. Rock or wood barriers will be maintained to limit the size and area of disturbance at the sites, and to limit motorized vehicle access within riparian areas. Management at the improved sites has been largely effective at reducing impacts, however at some locations, continued use, and increases in the size and number of sites are perpetuating impacts to riparian areas and aquatic habitat. The Forest's ability to manage the improved sites to reduce the effects to aquatic and riparian resources should be improved with implementation of the action alternatives as cross-country travel will no longer be permitted, and with the identification of designated routes and corridors the Forest will be in a better position to enforce unauthorized uses including camping adjacent, to but outside the boundaries of the improved sites.

Cumulative Effects of the Travel Management Alternatives Considering Past, Present and Reasonably Foreseeable Future Actions

Alternative A.

Alternative A would not ban cross-country travel, or change the current Forest Service transportation system. The use and continued creation of both authorized and unauthorized motorized vehicle roads and trails would have negative impacts for soil, fish and aquatic species. Temporary road creation associated with reasonable foreseeable future actions may increase sediment production and delivery, or affect water quality which could increase impacts to aquatic resources. Future projects such as road decommissioning and mineral development (see Appendix a in the EA for specific projects) have both beneficial and negative impacts. The effects of management activities on overall watershed health, water quality, soils and fish cannot be quantified. Some actions would improve conditions others will degrade them. Most current project design criteria are developed to minimize negative effects, so although present and future projects may not increase impacts to soil, water and fish, the continued use of existing unauthorized routes and potential for the proliferation of additional unauthorized routes near water as a result of the Forest being open to cross-country travel would likely result in the production and delivery of sediment to stream networks, impacts to riparian vegetation, and site specific increases in detrimental soil conditions. These impacts could potentially degrade aquatic habitats by affecting spawning are rearing through elevated fine sediment, and impairing aquatic habitat through increases in stream temperature (See Best Available Science and Rationale). The cumulative effect of Alternative A and the past, present, and reasonably foreseeable future actions would be a gradual degradation in watershed condition.

Alternatives B, C, and D (Action Alternatives)

Alternatives B, C, and D would ban cross-country travel but not change the current Forest Service transportation system. The cessation of use of unauthorized motorized vehicle roads and trails would have positive impacts for soil, fish and aquatic species. Temporary road creation associated with reasonable foreseeable future actions may increase sediment production and delivery, or affect water quality which could increase impacts to aquatic resources. Future projects such as road decommissioning and mineral development (see Appendix A in the EA for specific projects) have both beneficial and negative impacts. The effects of management activities on overall watershed health, water quality, soils and fish cannot be quantified. Some actions would improve conditions others would degrade them. Most current project design criteria are developed to minimize negative effects, so although present and future projects may not increase impacts to soil, water and fish, the discontinuation of the use of existing unauthorized routes and potential for the proliferation of additional unauthorized routes near water as a result of the Forest being closed to cross-country travel would result in a reduction and delivery of sediment to stream networks, impacts to riparian vegetation, and site specific increases in detrimental soil conditions. The cumulative effect of Alternative B, C, or D and the past, present and reasonably foreseeable future actions would be an improvement in watershed condition. (See Best Available Science and Rationale).

5.0. Conclusion

5.1. Compliance with other laws and regulations

Endangered Species Act (ESA). All alternatives comply with the ESA. None of the alternatives, if implemented, would be likely to jeopardize the continued existence of a threatened or endangered species, or result in the destruction or adverse modification of habitat of such species that is determined to be critical. Alternative A however would potentially adversely affect CFH more than the other alternatives and pose the greatest potential of the alternatives to contribute to threats to recovery of ESA listed fish. All required consultation will be completed prior to the Travel Management decision.

Land and Resource Management Plans (LRMP). Standards and Guidelines for the WNF and ONF LRMPs are superseded by the NWFP, INFISH, and PACFISH when the latter plans are more stringent. Wenatchee standards and guidelines for riparian, fish, and water resources are covered by ACS and NWFP standards. Okanogan LRMP standards and guidelines follow.

ONF 2-1. Riparian Reserves and RHCAs were considered during alternative design and used for analysis. RR/RHCA distances exceed those of the ONF LRMP.

ONF 2-2. See Northwest Forest Plan (NWFP), INFISH and PACFISH below.

ONF 2-4. See Northwest Forest Plan (NWFP), INFISH and PACFISH below.
ONF 2-5; 2-6, 2-7. While riparian impacts from dispersed recreation are not strictly a management activity, riparian habitat has been impacted in the past by this activity. Design criteria for corridors, and the Monitoring and Mitigation Plan would allow for the application of maintenance standards and provide a mechanism to insure that riparian habitat would be maintained or improved through time.

ONF 2-9. See Northwest Forest Plan (NWFP), INFISH and PACFISH below.

ONF 2-11. See Northwest Forest Plan (NWFP), INFISH and PACFISH below.

ONF 2-12. See Northwest Forest Plan (NWFP), INFISH and PACFISH below.

ONF 3-1. See Northwest Forest Plan (NWFP), INFISH and PACFISH below.

ONF 3-3. Design criteria for corridors and application of the Monitoring and Mitigation plan would prevent an increase in sediment production. Reduction in open road miles both within RR/RHCAs and within watersheds would reduce sediment production and delivery to aquatic systems.

ONF 3-6. See ACS objectives below.

Northwest Forest Plan (NWFP), INFISH and PACFISH. NWFP, PACFISH and INFISH standards and guidelines are essentially the same in that they strive to avoid adverse effects on to the ACS, RMOs, and anadromous or inland fish. Compliance with the standards and guidelines are grouped and discussed below. All alternatives comply with the NWFP, PACFISH and INFISH. The management prescriptions for riparian areas were considered during the analysis process.

RF-2 (a-g). Watershed analyses have been completed through previous efforts for all of the areas where changes to the motorized system are proposed on the Forest and the changes would not prevent attainment of ACS objectives or RMOs. This EA, as part of the larger Travel Management Planning effort, serves as another step in the development and implementation of a Road Management Plan that will be followed by Minimum Roads Analysis completed at the district level. This project would provide access to dispersed recreation through the use of corridors. Design Criteria and the Monitoring and Mitigation plan would ensure that these newly designated corridors meet ACS and RMO objectives, would not adversely affect anadromous and listed fish, and proliferation of roads within RR/RHCAs would not occur.

RF-3 (a-c) Designation of corridors which allow motor vehicle use on existing access routes to established dispersed campsites within RR/RHCAs would be formally monitored and allow for improvement, repair, or removal if necessary to meet these standards. The Monitoring and Mitigation Plan would allow for the prioritization of repair and or closure of those sites that are having adverse effects on either anadromous or inland fish.

RM-2 The use of the Monitoring and Mitigation Plan would allow for adjustment of motorized vehicle use for dispersed camping when the use has the potential to retard or prevent attainment of ACS objectives or RMOs.

Aquatic Conservation Strategy Objectives

All action alternatives will be consistent with ACS objectives. Alternative C with the least amount of Corridors within RR/RHCA would be expected to provide the greatest benefit to riparian and aquatic resources while Alternative D would comparatively pose the most risk to maintaining or improving the ACS objectives, compared to the other action alternatives.

Objective 1: Maintain and restore the distribution, diversity and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

Closure of the Forest to cross-country motorized travel would reduce localized impacts across the larger landscape and would help to reduce localized impacts to landscape scale features. Many of the actions made through this project are predominately local and occur at the site level, as such, none of these actions would affect landscape scale features. Current distribution, diversity, and complexity of watershed and landscape-scale features would by maintained or improved by closing the vast majority of the Forest to cross-country motorized travel. Designation of corridors, with the provisions that limit motor vehicle access in proximity to streams would serve to maintain site features at both the site scale and within RR/RHCA in the larger landscape level maintaining or improving aquatic systems within the project area.

Objective 2: Maintain and restore spatial and temporal connectivity in and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

Due to the site level scale of the actions proposed for the MVUM, none of the action alternatives would have a discernible effect on spatial and temporal connectivity between watersheds. Reducing the acreage open to cross-country motorized use would prevent proliferation of unauthorized routes in uplands and within RR/RHCAs and would maintain spatial and temporal connectivity locally. Designation of Corridors, and provisions within Corridors would maintain current levels of connectivity in RR/RHCAs by preventing incremental growth of disturbed areas in RR/RHCAs. Decreasing the mileage of open routes in RR/RHCAs and subsequent re-vegetation of currently open routes in RR/RHCAs would also restore some level of connectivity in watersheds within the project area.

Objective 3: Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

The current condition has open routes within RR/RHCAs which can create and deliver sediment to aquatic systems, impact vegetation, and alter local hydrologic conditions. All action alternatives were screened to ensure actions would meet Forest Plan standards. Decreasing open road miles in RR/RHCAs, and designation of Corridors in the action alternatives with provisions for motorized use within Corridors would maintain, and may improve, the current integrity of aquatic systems by decreasing sediment production and delivery to aquatic systems and preventing incremental growth of disturbed areas. Through time, vegetation recovery resulting from these actions would improve the integrity of aquatic systems.

Objective 4: Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individual composing aquatic and riparian communities.

The action alternatives decrease open road mileage within RR/RHCAs and would maintain and lead to improvements in water quality by reducing the potential for sediment production and delivery to aquatic systems. Similarly, designation of corridors with provisions for the use of motorized vehicles within the corridors would also maintain water quality by preventing increases in the motorized footprint within RR/RHCAs and adjacent to waterways. Resulting vegetation recovery with time would improve microclimate conditions within RR/RHCAs which would also improve water quality by maintaining thermal regimes.

Objective 5: Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

The action alternatives would maintain the current sediment regimes in watersheds across the forest. Eliminating motorized cross country travel would decrease sediment production on unauthorized routes passing through RR/RHCAs, and from general cross country travel in RR/RHCAs. Decreases in open road mileage within RR/RHCAs would decrease sediment production and delivery to aquatic ecosystems locally at the site level. Similarly, limiting motorized travel in RR/RHCAs with designated corridors would prevent increases in sediment production and delivery locally, but site level improvements may not be recognizable at the watershed scale.

Objective 6: Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

The action alternatives would designate corridors and are designed to prevent increases in the motorized footprint within RR/RHCAs. Current flow hydrologic pathways would be maintained, and may be improved through revegetation near stream courses. Overall road densities would not change and the current changes to the drainage network and drainage efficiencies within watershed would stay the same. Reduction in open road density and subsequent re-vegetation of routes may lead to a decrease in drainage efficiencies which may serve to improve water routing and timing within watersheds to the benefit of aquatic species and functions but it is unlikely that the changes would be recognizable at the watershed scale.

Objective 7: Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

Due to the site level scale of the actions proposed there would not be any change in the attributes of timing, variability, or duration of floodplain inundation which operate on a watershed scale. Corridor designation with provisions that prevent an increase in motor vehicle footprint would prevent increases of potential impacts to floodplains, meadows and wetlands by limiting the chance for increased rutting, and water routing at the local site level.

Objective 8: Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

Eliminating cross-country motor vehicle use in RR/RHCAs in the action alternatives would prevent impacts to vegetation related to unregulated motor vehicle use within RR/RHCAs. The special provisions within Corridors would prevent the increase of impacts to vegetation in RR/RHCAs, particularly adjacent to stream courses and would maintain or improve current thermal regulation at the site level by eliminating vegetation removal adjacent to streams. Preventing the proliferation of routes within corridors through the use of special provisions would maintain current conditions in RR/RHCAs. Designating only appropriate roads to access dispersed recreation outside of corridors in RR/RHCAs would reduce sediment production and delivery as undesignated routes re-vegetate.

Objective 9: Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

At the local site level, provisions which prevent the increase of the motor-vehicle footprint in RR/RHCA such as designation of Corridors, and reducing the open road density in RR/RHCAs would allow for re-vegetation through time of undesignated routes under the action alternatives, which would benefit native plant, invertebrate, and riparian dependent vertebrate species. It is unlikely that the benefits would be recognizable at the watershed scale.

Clean Water Act and 303(d)

The implementation strategy for the Wenatchee National Forest Water Temperature Total Maximum Daily Load is based on the amended Wenatchee National Forest Plan, specifically the Aquatic Conservation Strategy. Forest Plan standards and associated riparian protection levels contained within the plan, serve as a benchmark for design of the TMDL assessment and are fundamental components of the TMDL implementation (WDOE, 2003). Meeting regulatory requirements of ACS objectives infers compliance with the Clean Water Act and the TMDL for temperature of 303(d) streams. As stated in ACS objective #4 above, temperature would be maintained. Meeting INFISH, PACFISH, and Okanogan

Forest Plan standards and guidelines for RHCAs, Riparian ecosystems, and streambank vegetation would ensure that vegetation and shading is maintained or improved along stream courses on the portion of the forest covered by the Okanogan Forest Plan. This would allow compliance with the CWA. None of the Travel Management alternatives would have any effect on dioxins, PCBs, dissolved oxygen, pH, copper, lead, mercury or silver and therefore would not affect the 303(d) listings for these.

Riparian Management Objectives

None of the alternatives would have any measurable effect on pool frequency or large woody debris. Water temperature, and bank stability, would be maintained on streams near designated open roads and trails because of either the prohibition of cross country travel off of designated routes, or the restrictions on motorized vehicle use in corridors. All designated open roads and motorized trails are currently already in use. Current impacts to RHCAs would be reduced forest-wide and watershed specific basis because of the closure of the Forest to cross country travel.

In summary, all action alternatives should maintain or improve the attainment of RMOs. The potential improvement in RMOs would be greatest with implementation of Alternative C as there would be the least amount of corridors within RHCAs. Alternative D would comparatively pose the most risk to maintaining or improving RMOs due to the project.

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