DOE/RL-2000-27
Revision 2

Threatened and Endangered Species Management Plan: Salmon, Steelhead, and Bull Trout

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF ENERGY | Richland Operations Office

P.O. Box 550
Richland, Washington 99352

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Executive Summary

This *Threatened and Endangered Species Management Plan for Salmon, Steelhead, and Bull Trout* defines the U.S. Department of Energy-Richland Operations Office (RL) commitment to protecting the stocks of Upper Columbia River spring Chinook salmon (*Oncorhynchus tschawytscha*), Upper Columbia River steelhead (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*) within the Hanford Reach of the Columbia River. The National Marine Fisheries Service (NMFS) is responsible for administering the Endangered Species Act (ESA) with regard to listed steelhead and Chinook salmon while the U.S. Fish and Wildlife Service (USFWS) is responsible for administering the ESA with regard to listed bull trout. In addition, federal agencies are required, under 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and its implementing regulations, to consult with NMFS regarding actions that agency authorizes, funds, or undertakes that may adversely affect Essential Fish Habitat (EFH). As partial fulfillment of RL's responsibilities under the ESA and Magnuson-Stevens Act, this plan constitutes a partial consultation between the RL, NMFS, and USFWS. In addition to this management plan, RL has agreed to request project-specific consultation under Section 7 of ESA for remediation projects occurring below the wetted edge of the Columbia River.

Specific objectives of this management plan are to:

- Identify the types of RL actions and facilities at the Hanford Site that could impact listed steelhead, spring Chinook salmon, bull trout, or their critical habitat within the Hanford Reach.
- Identify means to avoid or minimize the potential adverse impacts of RL actions and facilities on listed species.
- Identify which actions will have:
    - *No effect* on listed species – RL usually will proceed with these actions without additional interactions with NMFS or USFWS.
    - *May affect, but are not likely to adversely affect* listed species or their critical habitat - RL will provide NMFS and USFWS with information for concurrence with this finding on a project-by-project basis prior to project implementation.
    - Undetermined impacts – these actions will require specific formal or informal consultation under the ESA because of the potential to impact listed species or their critical habitat. Actions or activities not considered within this plan will fall into this category.

Hanford Site activities that have the potential for impacting salmonids include waste site remediation, construction, water withdrawals, permitted wastewater discharges, groundwater monitoring near the shoreline, groundwater treatment activities conducted near the shoreline,

ecological and cultural research and monitoring programs, and pesticide applications. Potential effects include impingement and entrainment from water withdrawals, toxicity of wastewater discharges, shoreline and riverbed modifications that affect habitat, siltation from surface runoff, toxic modifications of groundwater plumes, harassment from boat traffic on RL Projects, noise, and incidental capture during biological monitoring activities. Given the present status of permits and the design and mitigation qualifications defined in this plan for these activities, none of the planned actions or potential effects is likely to adversely affect the listed salmonids within the Hanford Reach or modify critical habitat.

To ensure protective management of these listed species, RL will ensure that Hanford Site contractors conduct all activities so as to preserve, protect, and perpetuate steelhead spawning and rearing habitat and the migration corridor for spring Chinook adults and juveniles as well as bull trout. Protection measures include the following best management practices and designing and implementing projects to meet the following criteria:

- Adverse impacts due to water withdrawal will be avoided by reducing the magnitude of water withdrawn from existing intakes, when possible, and ensuring all water diversions meet state of Washington and NMFS screening criteria or appropriate administrative controls, such as the timing of withdrawal.

- Heavy equipment use below the ordinary high water mark (OHWM) will be minimized. When heavy equipment below the OHWM is required, strict best management practices will be followed to prevent spills, sedimentation, and other potential impacts.

- No blasting or other loud percussive noises will occur below the OHWM without additional consultation with NMFS and/or USFWS.

- Removal of native riparian or emergent vegetation will be minimized. Whenever possible, projects in riparian areas will be located where vegetation is already disturbed; vegetation will be mowed when complete removal is not needed. Damaged vegetation will be replaced with native species for erosion protection. Whenever possible, hand-tools will be used for in-water work.

- Whenever possible, construction projects will not simplify the shoreline structure[1]. Modifications will be limited to shoreline areas that have been previously disturbed, or will maintain as much of the natural shoreline configuration as possible, and will incorporate mitigation measures into project design to replace the shoreline configuration.

[1] Shoreline simplification refers to any method that reduces the variation of the physical or biological environment along the waterway.

- When possible, riverbank protection, where required for a given project, will use bioengineering rather than hard armor[2]. Projects will use accepted Washington Department of Fish and Wildlife (WDFW) guidelines when designing streambank protection measures, and RL will consult with NMFS and USFWS when armoring projects are required.

- All fill material used below the OHWM will be in-kind to native shoreline materials (i.e., ancestral Columbia River cobble from local borrow sources). These materials are relatively free of fines and are relatively stable under current river conditions; they should therefore result in minimal releases of sediment following completion of the shoreline projects and subsequent inundation by higher river levels. Fill will be placed and contoured so as to minimize the potential for stranding of juvenile fish. Materials will be "placed" on the banks rather than "dumped" to minimize river turbidity.

- Silt-loaded surface runoff from near-shore areas disturbed by RL Project activities will be minimized by avoiding impacts to shoreline vegetation and using accepted best management practices to control runoff and erosion. Adherence to stormwater management plans will reduce potential impacts from runoff to salmonid habitat.

- When working below the ordinary high water mark (OHWM), but above the wetted perimeter, RL Project activities will minimize adverse impacts to listed salmonids by conducting disruptive activities at locations and during time periods when fish are absent or present in low numbers.

- No activities that could result in capture or harm to steelhead or spring Chinook salmon will be conducted without undergoing consultation with NMFS. No activities that would adversely modify critical habitats (the Columbia River and its riparian zone) or essential fish habitat as defined in the Magnuson-Stevens Act will be conducted without specific consultation with NMFS.

- No activities that could result in capture or harm to bull trout will be conducted without undergoing consultation with USFWS. No activities that would adversely modify critical habitat (the Columbia River and its riparian zone) will be conducted without specific consultation with USFWS.

If Hanford Site activities are carried out in accordance with this plan, they are not likely to significantly affect steelhead, spring Chinook salmon, or bull trout or modify their critical habitat. Activities conducted in accordance with this plan that include the best management practices described will most likely not require formal or informal consultation with NMFS or USFWS. However, RL will coordinate with these agencies before

[2] Hard armor refers to structures placed on the shoreline to reduce erosion and consists of hard materials such as stone, rock, boulders, concrete, sheet pile, gabions (stone-filled wire baskets), rock rip-rap etc.

project implementation and will provide sufficient information for them to determine this plan and best management practices are being implemented, and the general determinations of *no effect* or *not likely to adversely affect* (depending on the action) are applicable to the specific action. Some potential actions described in this plan, and any activities performed not in accordance with or described in this plan, will require formal or informal (whichever is appropriate) consultation with the NMFS and/or USFWS as required by the ESA.

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Acronyms and Abbreviations

BA	Biological Assessment
BMP	Best Management Practices
BRMP	Hanford Site Biological Resources Management Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EFH	Essential Fish Habitat
EPA	U. S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
FMO	Foraging, Migration, and Overwintering
HRNM	Hanford Reach National Monument
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPDES	National Pollution Discharge Elimination System
OHWM	Ordinary High Water Mark
OLWM	Ordinary Low Water Mark
RK	River Kilometer
RL	U. S. Department of Energy, Richland Operations Office
RM	River Mile
SWPPP	Stormwater Pollution Prevention Plan
USFWS	U. S. Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife
WSAHGP	Washington State Aquatic Habitat Guidelines Program

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1.0 INTRODUCTION

Spring Chinook salmon (*Oncorhynchus tschawytscha*), steelhead (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*) within the Hanford Reach of the Columbia River are listed for protection under the Endangered Species Act (ESA). This management plan documents the U.S. Department of Energy-Richland Operations Office (RL) commitment and approach to protect stocks of these species within the Hanford Reach. This plan also constitutes a partial consultation between RL and the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) as required under the ESA[3]. Specific objectives of this plan are to:

- identify the types of RL actions and facilities at the Hanford Site that could impact listed steelhead, spring Chinook salmon, bull trout, or their critical habitat within the Hanford Reach.
- identify means to avoid or minimize the potential adverse impacts of RL actions and facilities on listed species.
- identify which actions will have:
    - *No effect* on listed species – RL usually will proceed with these actions without additional interactions with NMFS or USFWS.
    - *May affect, not likely to adversely affect* listed species or their critical habitat - RL will provide NMFS and USFWS with information for concurrence with this finding on a project-by-project basis prior to project implementation.
    - Undetermined impacts – these actions will require specific formal or informal consultation under the ESA because of the potential to impact listed species or their critical habitat. Actions or activities not considered within this plan will fall into this category.

Federal agencies are obligated, under Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and its implementing regulations (50 CFR 600), to consult with NMFS regarding actions that are authorized, funded, or undertaken that may adversely affect Essential Fish Habitat (EFH). The Magnuson-Stevens Act defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” This plan represents a partial consultation with regard to the Magnuson Stevens Act. RL actions, if carried out in accordance with this plan, are not likely to adversely impact EFH.

[3] In addition to this document, RL has agreed to request project-specific consultation under Section 7 for remediation projects occurring below the wetted edge of the river.

1.1 HANFORD SITE BACKGROUND

The Hanford Site occupies most of the Columbia River shoreline between Priest Rapids Dam and the city of Richland (Figure 1). This stretch of the river comprises the last free-flowing portion of the Columbia River within the United States above Bonneville Dam.

Since the late 1980s, RL's mission at the Hanford Site has been to clean up and stabilize facilities, wastes, and contaminated areas associated with Hanford's former role in nuclear weapons production from 1943 to the late 1980s. Currently, the primary mission at Hanford focuses on environmental restoration, which includes remediation of contaminated areas, decontamination and decommissioning of site facilities, waste management, and related scientific and environmental research and development of waste management technologies. Completion of this mission requires a variety of activities that will occur within the Columbia River and on its shoreline or could alter groundwater flows and/or composition entering the river.

The Hanford Site was developed during the World War II Manhattan Project as a site to produce plutonium for nuclear weapons. The first plutonium-production reactors at the Hanford Site used single-pass cooling systems that discharged cooling water directly to the Columbia River, relying on dilution to minimize impacts. Improvements in technology and operations protocols reduced the amount of contaminants discharged to the river by redirecting effluents to various land-based storage systems. The Clean Water Act of 1977, as amended, applies to discharges to surface waters in the United States. At the Hanford Site, regulations are applied through the EPA Administered Permit Programs: The National Pollutant Discharge Elimination System (NPDES, 40 CFR 122). DOE does not currently have any discharges to the Columbia River requiring permits.

The Hanford Site comprises 1,517 km^2 (586 mi^2), subdivided into various DOE-administered operational areas with specific functions. Of these, the six 100 Areas and the 300 Area are closest to the Columbia River and have the most potential for affecting listed salmonids. The Hanford Site includes a 789 km^2 (305 mi^2) area that was designated as the Hanford Reach National Monument in 2000. RL is the landowner of the entire Hanford Site, although portions of the Monument are managed by USFWS.

Steelhead are present in the Hanford Reach all year. Most adults move into the Hanford Reach from August to November, where they may reside for 6 to 8 months near shorelines at depths less than 3 m (10 ft). Juveniles usually spend 1 to 3 years in freshwater before migrating downstream to the ocean. Outmigration through the Hanford Reach usually occurs between April and June. Limited spawning may occur within the Hanford Reach between February and early June, with peak spawning in mid-May. Fry emerge from the nest 2 to 3 weeks after hatching and school near the margins of the river and over shallow water gravel bars. Streamside vegetation and submerged cover provide protection from predators, moderate temperatures, and colonization sites for steelhead food sources. As fry grow larger they feed primarily on food found along the bottom of the river, including midges, mayflies, stoneflies, and beetle larvae.

Figure 1. Principal Features of the Hanford Site

Spring Chinook salmon do not spawn within the Hanford Reach; however, the Hanford Reach is used by in-migrating adult salmon as a passage corridor and by out-migrating juvenile salmon as a migration corridor and interim feeding. Individual juveniles do not spend more than 1 week in the Hanford Reach, although the outmigration period extends from April to the end of August.

Bull trout require colder water than all other Columbia River Basin salmonids, and they generally reside and spawn in smaller streams at higher elevations. Therefore, their presence in the Hanford Reach is most likely limited by relatively warm summer water temperatures. However, there is limited evidence confirming occasional bull trout presence in the Hanford Reach, which is designated critical habitat for this species based primarily on its functionality as a migration corridor. It is believed migratory bull trout also use the Hanford Reach for foraging and overwintering. The mainstem upper Columbia River Critical Habitat Unit, which includes the Hanford Reach, is essential for maintaining bull trout distribution within the Mid-Columbia region and conserving the fluvial migratory life history exhibited by many populations from adjacent core areas.

1.2 HANFORD SITE LAND USE

The Hanford Site comprises approximately 1,517 km^2 (586 mi^2) within the lower Columbia Basin, and is subdivided into operational areas (Figure 1), each with specific functions, as described below:

- The six 100 Areas along the south and west banks of the Columbia River are the locations of the nine former plutonium-production reactors that were shut down between the mid-1960s and the mid-1980s. Most waste sites associated with these reactors have been remediated, and most reactor buildings have been stabilized and are awaiting final disposition.
- The 200 Areas (East and West), located on a plateau about 10 km (6 mi) from the Columbia River, were dedicated to processing nuclear fuel and for waste management and disposal activities.
- The 300 Area, located just north of the city of Richland, was used for fuel assembly and test reactor experiments. Most buildings have been removed, but it still contains several research facilities and various laboratories.
- The 400 Area, about 8 km (5 mi) north of the 300 Area, is the location of the retired experimental reactor known as the Fast Flux Test Facility.
- The 600 Area is the core of the Hanford Site not designated as an operations area, although it does contain some waste disposal sites. This area is further subdivided as follows:
    - 0.4 km^2 (100 ac) is leased by Washington State and contains a commercial low-level radioactive waste disposal facility known as the US Ecology Low-Level Radioactive Waste site.
    - Energy Northwest leases 4.4 km^2 (1.7 mi^2) along the Columbia River north of the 300 Area for operation of the Columbia Generating Station for nuclear power production.
    - The Hanford Reach National Monument (HRNM), which is mostly managed by the USFWS. The USFWS-managed portions of the HRNM include:

- The Rattlesnake Unit (Fitzner-Eberhardt Arid Lands Ecology Reserve), which occupies 310 km^2 (121 mi^2) in the southwest quadrant of the Hanford Site.
- The Wahluke (East and West), Saddle Mountain, and Ringold Units, which comprise a
- 355-km^2 (139-mi^2) area on the north and east banks of the Columbia River.

Although the USFWS manages portions of the Site, RL is the landowner of the entire Hanford Site. This plan does not cover actions taken by the USFWS within the HRNM. Recreational or other non-RL uses of the Hanford Reach within Site the boundaries are outside the scope of this plan. The long-term vision for land use within the Hanford Site has been evaluated and set forth in the *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (DOE 1999a) and its implementing documents, including the *Hanford Site Biological Resources Management Plan* (DOE 2013b).

The 100 and 300 Areas are closest to the Columbia River, and operations in these areas have the greatest potential for affecting listed salmonids. Areas remote from the Columbia River, such as 200 East and 200 West, are sources of contaminated groundwater that has reached the river in some cases.

1.3 CONSULTATION HISTORY

The original Hanford Site *Threatened and Endangered Species Management Plan for Salmon and Steelhead* (DOE/RL-2000-27) was prepared during the late 1990s in response to the listing of Upper Columbia River spring Chinook salmon and Upper Columbia River steelhead as endangered species under the ESA. This management plan was initially published in April 2000, but NMFS did not concur with all provisions of that plan. In 2006, RL prepared an addendum to the plan to specifically address waste site remediation projects that were required along the Columbia River (DOE 2006). In its response letter (NMFS 2007) NMFS concurred with the conclusions of *may affect, not likely to adversely affect* for remediation actions that occurred above the wetted perimeter of the river, given certain stipulations and limitations. NMFS did not concur with a similar determination for actions below the wetted perimeter of the river. RL currently requests project-specific consultation under Section 7 of ESA for remediation projects occurring below the wetted edge of the river.

Although RL can make determinations of *no effect* without consultation with the respective agencies, RL routinely contacts NMFS and USFWS to address potential impacts associated with projects occurring in the nearshore areas. RL has also conducted several informal consultations for projects that *may affect, but not likely adversely affect* listed species or their habitat.

In 2008, RL requested consultation to support various sampling activities associated with the Columbia River Corridor Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Investigation (DOE 2008). NMFS determined that the proposed sampling efforts may affect, but were not likely to adversely affect listed spring-run Chinook, steelhead, or their critical habitat, and that the proposed conservation measures would be adequate to protect essential fish habitat for fall-run Chinook and coho (*Oncorhynchus kisutch*) salmon (NMFS 2008). This determination was reaffirmed and extended indefinitely in July 2013 (NMFS 2013a).

In fall 2010, RL prepared two separate biological assessments (BA) for the removal and remediation of river intake structures: one for the demolition/disposition of the 181-KE and 181-KW river intake structures (CHPRC 2010a) and one for the demolition of 181-N and 181-NE intake structures and the 1908-NE discharge structure (DOE 2010). Both BAs evaluated potential impacts to Upper Columbia River spring Chinook salmon, Upper Columbia River steelhead, and bull trout. The USFWS concurred with the *may affect, not likely to adversely affect* determination for bull trout for the 181-KE /181-KW project on January 18, 2011 (USFWS 2011a), and for the 100-N Area project on July 14, 2011 (USFWS 2011b). NMFS provided comments on the BA for the 100-K Area project, but did not provide a formal concurrence with the *may affect, not likely to adversely affect* determination for steelhead and spring Chinook salmon. RL determined that it had met the substantive requirements of the ESA, and chose to proceed under provisions of CERCLA and completed the project in 2011. NMFS provided a Biological Opinion on August 1, 2011, for the 100-N Area work, which determined that the proposed work at 100-N would *adversely affect* listed species, but would not jeopardize the species or result in the destruction or adverse modification of designated critical habitat (NMFS 2011a). An incidental take statement was provided with the Biological Opinion for 100-N.

In July 2011, RL submitted a BA that assessed potential impacts on bull trout from electrofishing and hook-and-line fishing for collection of environmental monitoring samples (DOE 2011). The USFWS concurred with the *may affect, not likely to adversely affect* determination regarding these activities on July 25, 2011 (USFWS 2011c). Other environmental sampling activities have been performed for RL under consultations or Section 10 of the ESA permits obtained by DOE subcontractors.

In March 2013, RL prepared a BA for the installation of a series of piezometers along the shoreline of the Columbia River near the 300 Area (DOE 2013a), concluding that the piezometer installation *may affect but not likely to adversely affect* listed spring-run Chinook and steelhead or their critical habitat; NMFS concurred, and also concluded that the proposed action would not adversely affect essential fish habitat (NMFS 2013b). This consultation was extended to include the installation of aquifer tubes near the 100-B/C Area in July 2013 (NMFS 2013c).

In May 2014, RL prepared a BA examining the potential effects of the emplacement of an apatite barrier in the saturated zone sediments and vadose zone soils on ESA-listed fish in the Hanford Reach. The 762-m (2,500-ft) long permeable reactive barrier was designed to reduce the concentrations of strontium-90 in the groundwater being released to the Columbia River by approximately 90%. The BA concluded that the installation and operation of the apatite barrier in the 100-N Area *may affect, but was not likely to adversely affect* spring-run Chinook, steelhead, bull trout, or their critical habitat. Concurrence with this determination was received from USFWS for bull trout (USFWS 2014), and from NMFS (NMFS 2014) for spring-run Chinook salmon and steelhead.

In April 2015, RL submitted a BA in support of its request for informal consultation with NMFS and USFWS regarding the installation and operation of a groundwater treatment system designed to reduce the mobility of uranium that is a primary source of groundwater contamination in the Hanford Site 300 Area (DOE 2015a, 2015b). In May 2015, USFWS concurred with RL's determination that the Uranium Sequestration Groundwater Treatment Project *may affect, but not likely to adversely affect* bull trout and its designated critical habitat (USFWS 2015). In June 2015, NMFS reached a similar conclusion for spring-run Chinook salmon and steelhead and their designated critical habitats (NMFS 2015).

A draft version of this management plan was submitted to USFWS and NMFS in October 2012. USFWS concurred with the proposed determinations regarding bull trout, with a few stipulations (USFWS 2012). NMFS provided comments, but determined it required more information and had concerns with some proposed determinations. The document was revised to incorporate NMFS comments. In August 2013, RL and NMFS reached an agreement on the applicability and limitations of the proposed determinations and the procedures, as described in this document, for using this plan as the basis for future consultations. NMFS provided an approval letter in December 2013 (NMFS 2013d).

2.0 STATUS OF LISTED SPECIES

2.1 STEELHEAD

Historically, steelhead occurred in most streams from the northern Baja Peninsula to Alaska. During the present century, at least 23 indigenous stocks are thought to have been extirpated. The current range of the species in the contiguous United States extends from the U.S.-Canada border to the Los Angeles Basin (61 FR 56138).

Declines of steelhead stocks within the region have been attributed to a number of human and natural causes (62 FR 43937); human causes include:

- habitat loss, modification, or curtailment of use, especially from hydropower operations
- excess commercial or recreational harvest
- increased predation through introduction of non-native species and habitat modifications.

Steelhead within the Hanford Reach are part of the Upper Columbia River Evolutionarily Significant Unit (ESU) as defined by NMFS (61 FR 56138, 70 FR 52630 – see Figure 2). The Middle Columbia River and Snake River ESUs border the Upper Columbia River ESU to the south. The Middle Columbia River ESU includes the Yakima River drainage and the Columbia River downstream from its confluence with the Yakima River, while the Snake River ESU includes the Snake River drainage. A portion of the Hanford Site lies within the Middle Columbia River ESU, although there are no water discharges, water withdrawals, or perennial runoff from the Site within this ESU. Because of the lack of potential impact to this ESU, protection measures are not addressed in this plan.

On August 18, 1997, Upper Columbia Summer-Run Steelhead were listed as endangered under the ESA, with an effective date of October 17, 1997 (62 FR 43937). This status was upgraded to threatened on January 5, 2006; reinstated to endangered per a U.S. District Court decision in June 2007; and upgraded to threatened per a U.S. District Court order in June 2009. NMFS issued results of a 5-year review on August 15, 2011, and concluded that this species should remain listed as threatened (76 FR 50447) and subject to section 4(d) protective regulations under the ESA (71 FR 5177) as amended in June 2005 (70 FR 37160).

In the case of threatened species, ESA section 4(d) allows NMFS or USFWS to determine whether and to what extent conservation measures may be appropriate, and directs the agency to issue regulations it considers necessary and advisable for the conservation of the species. The agencies have flexibility under section 4(d) to tailor protective regulations based on the contributions of available conservation measures. The 4(d) protective regulations may prohibit, with respect to threatened species, some or all of the acts which section 9(a) of the ESA prohibits with respect to endangered species (70 FR 37160).

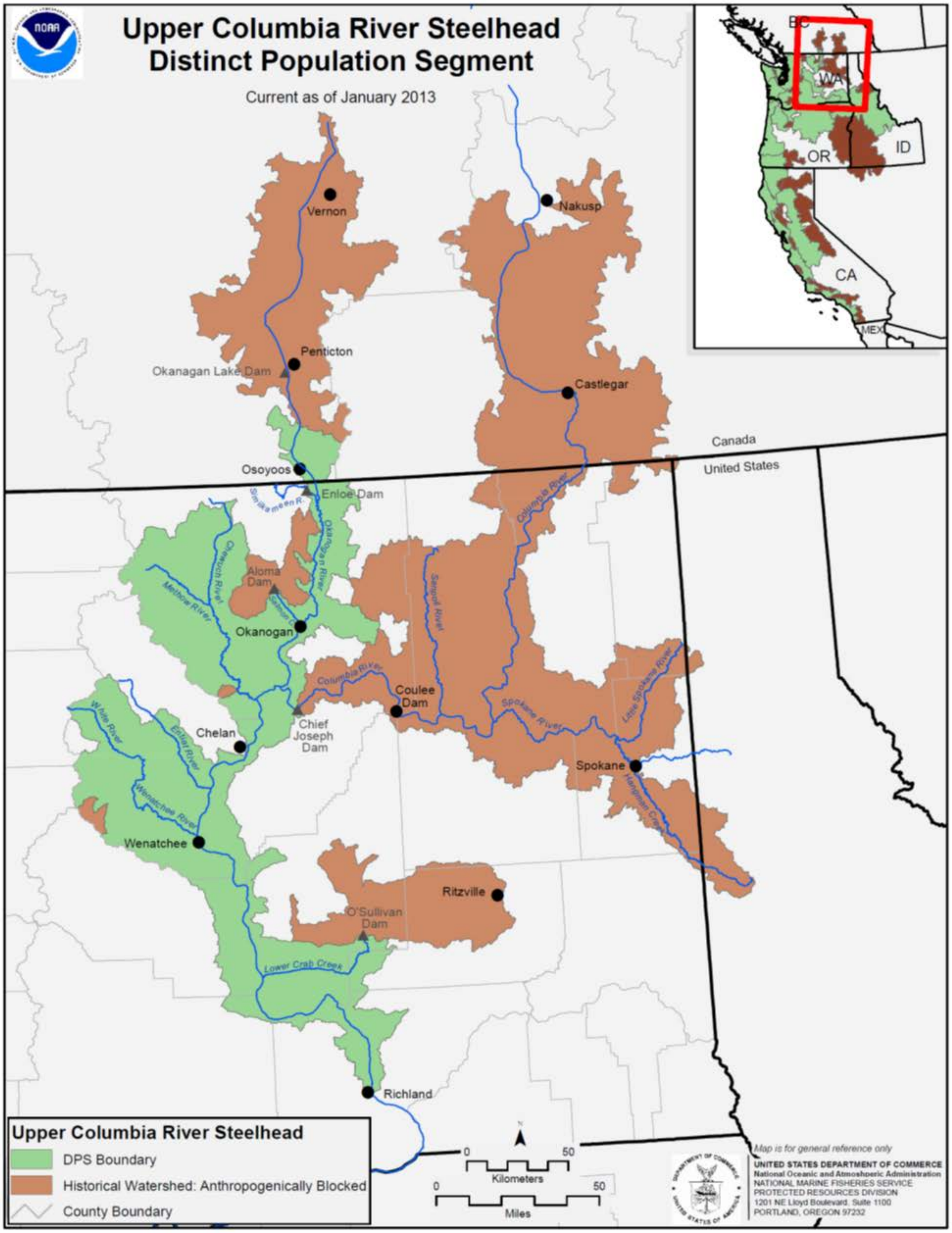

Figure 2. Upper Columbia River Steelhead Distinct Population Segment

Section 4(d) protections apply to natural and hatchery fish with an intact adipose fin, but not to listed hatchery fish that have had their adipose fin removed prior to release into the wild (71 FR 5177).

Steelhead covered under this listing include all naturally spawned anadromous steelhead populations and their progeny below natural and man-made impassable barriers in streams in the Columbia River Basin upstream of 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 National Fish Hatchery, Omak Creek, and Ringold steelhead hatchery programs. Steelhead within the Middle Columbia River ESU and the Snake River ESU are also listed as threatened.

Critical habitat is defined in section 3 of the ESA as--(i) the specific area within the geographical area occupied by a species, at the time it is listed in accordance with the Act, on which are found those biological features essential to the conservation of the species and that may require special management considerations or protection and; (ii) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. ``Conservation'' means the use of all methods and procedures needed to bring the species to the point at which listing under the ESA is no longer necessary.

Critical habitat for this ESU within the Hanford Site includes the entire Hanford Reach (65 FR 7764, 70 FR 52630– see Figure 3). Functions of this habitat within the Hanford Reach include juvenile rearing areas, juvenile migration corridors, areas for growth and development to adulthood, adult migration corridors, and spawning areas. To prevent impacts to this critical habitat, RL must ensure that its activities do not adversely affect substrate, water quality, water quantity, water temperature, water velocity, cover/shade provided by bank vegetation, food supplies, riparian vegetation, the space occupied by the river, or other conditions that limit safe passage of juveniles or adults (65 FR 7764).

Section 7(a)(1) of the ESA requires federal agencies to "utilize their authorities in furtherance of the purposes of [the ESA] by carrying out programs for the conservation of threatened and endangered species.” Section 7(a)(2) of the ESA requires that each federal agency shall, in consultation with, and assistance of USFWS and/or NMFS, ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of the species or result in the destruction or adverse modification of critical habitat.

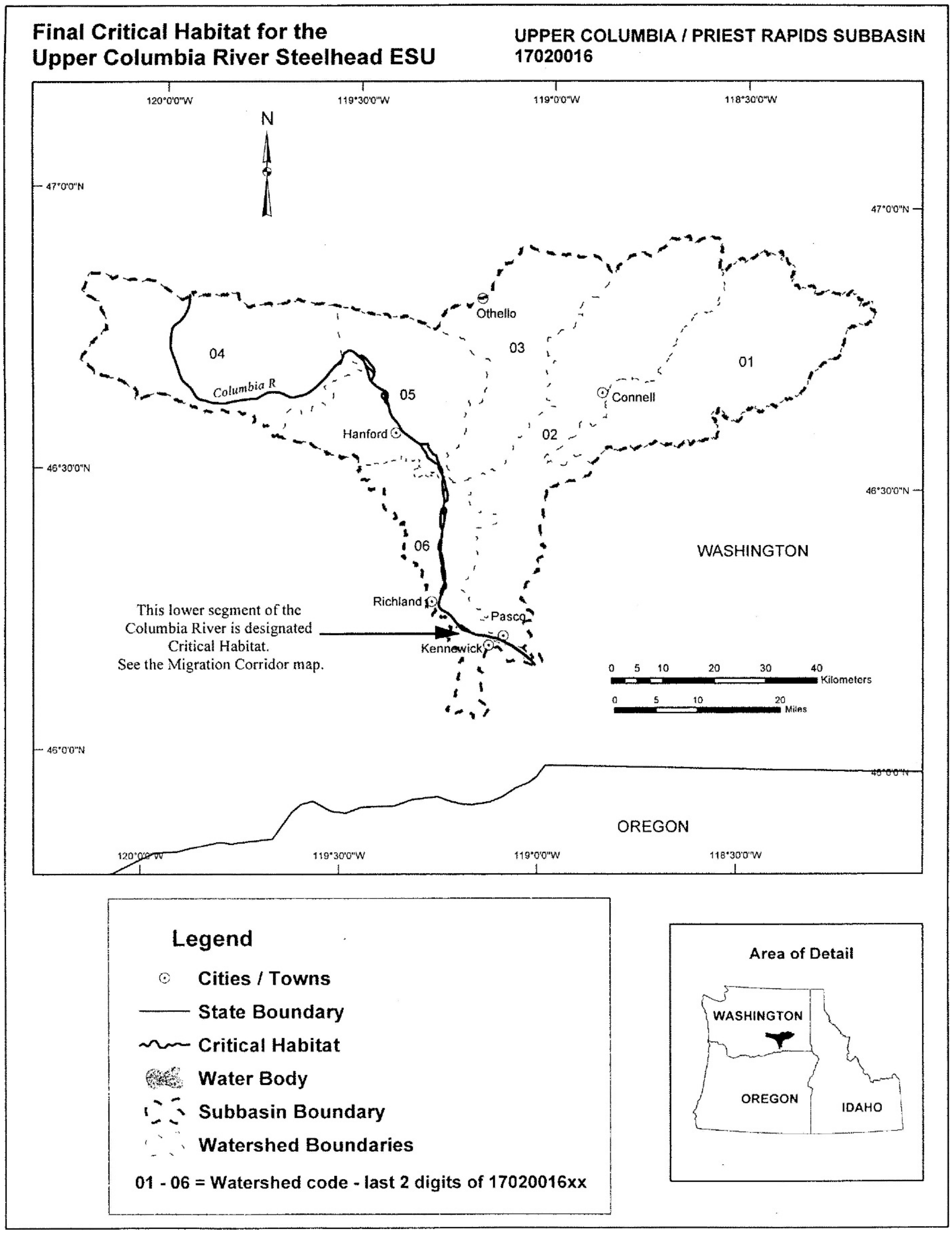

Figure 3. Upper Columbia River Steelhead Critical Habitat (source: 70 FR 52630)

2.2 SPRING RUN CHINOOK SALMON

On March 9, 1998, NMFS determined that ESA listing was not warranted for the Middle Columbia River Spring-Run Chinook ESU (63 FR 11482), which comprises all naturally spawned populations of spring-run Chinook salmon in Columbia River tributaries from the Klickitat River upstream, including the Yakima River but excluding the Snake River Basin. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 69,000 km^2 (43,000 mi) in Oregon and Washington. The Middle Columbia ESU does not include fish within the Hanford Reach, but does include fish that migrate through the Yakima River to spawning grounds in that drainage basin. RL Project activities are not expected to have any impacts on this ESU, and there will be no effect from Hanford Site operations on this ESU.

The Upper Columbia River Spring-Run ESU of Chinook salmon was listed by NMFS as an endangered species on March 24, 1999 (64 FR 14308 – see Figure 4). The endangered status was reaffirmed on June 28, 2005 (70 FR 37160). NMFS issued results of a 5-year review on August 15, 2011, and concluded this species should remain listed as endangered (76 FR 50447). This ESU includes all naturally spawned populations of Chinook salmon in all river reaches accessible to spring Chinook salmon in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam in Washington, 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. ESA section 9(a) take prohibitions apply to all species listed as endangered. Hatchery stocks determined to be part of endangered ESUs are afforded the full protections of the ESA (70 FR 37160).

These salmon do not spawn within the Hanford Reach, but it serves as a migration corridor for adults and juveniles, and juveniles may use the shallows of the Hanford Reach as rearing areas. A final designation of critical habitat was published on September 2, 2005, with an effective date of January 2, 2006. Critical habitat for this ESU within the Hanford Site includes the entire Hanford Reach, which functions as juvenile rearing habitat and a juvenile and adult migration corridor (70 FR 52630 – see Figure 5). To prevent impacts to this critical habitat, RL must ensure that Project activities do not adversely affect substrate, water quality, water quantity, water temperature, water velocity, cover/shade provided by bank vegetation, food supplies, riparian vegetation, the space occupied by the river, or other conditions that limit safe passage of juveniles or adults (65 FR 7764).

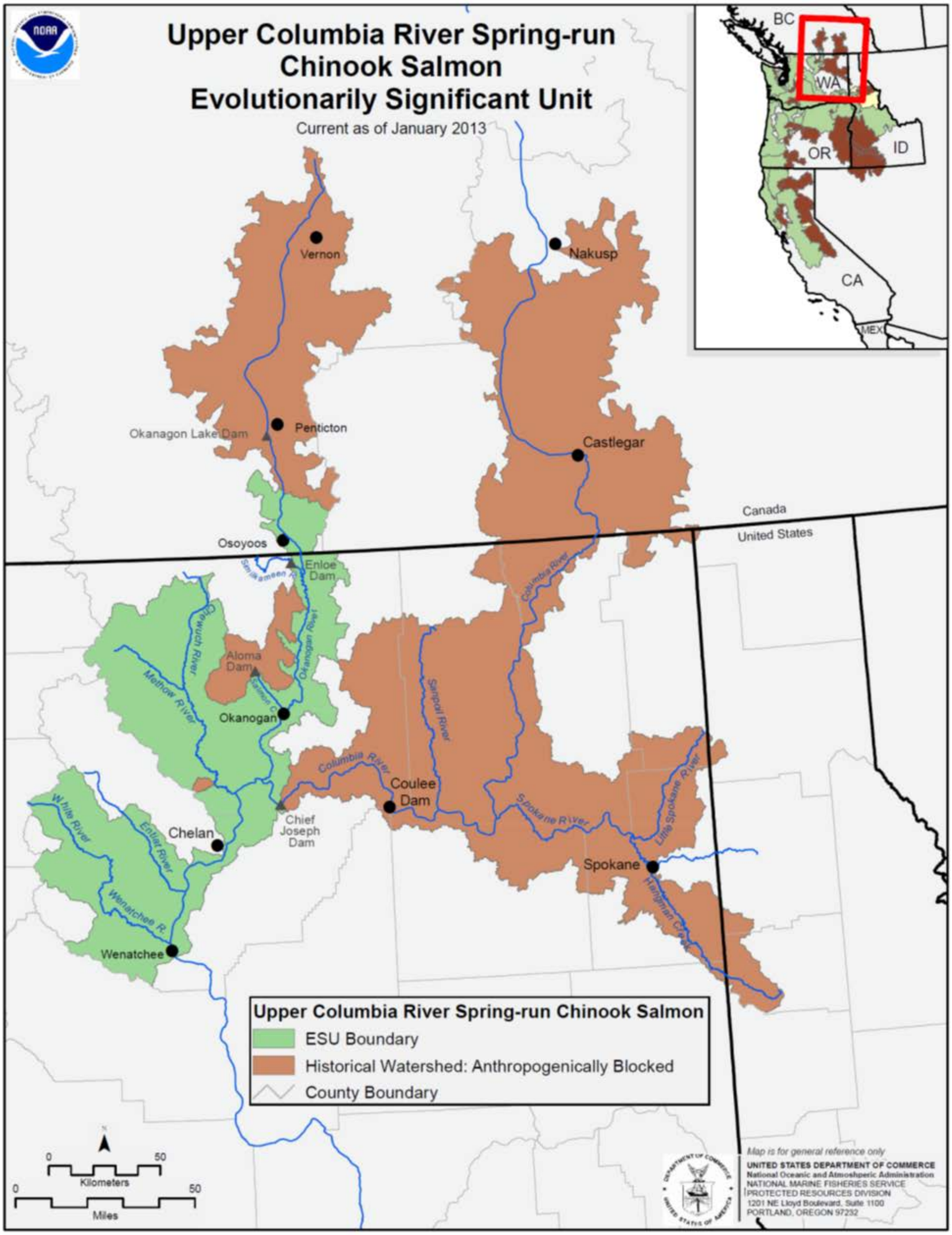

Figure 4. Upper Columbia River Spring-Run Chinook Salmon ESU

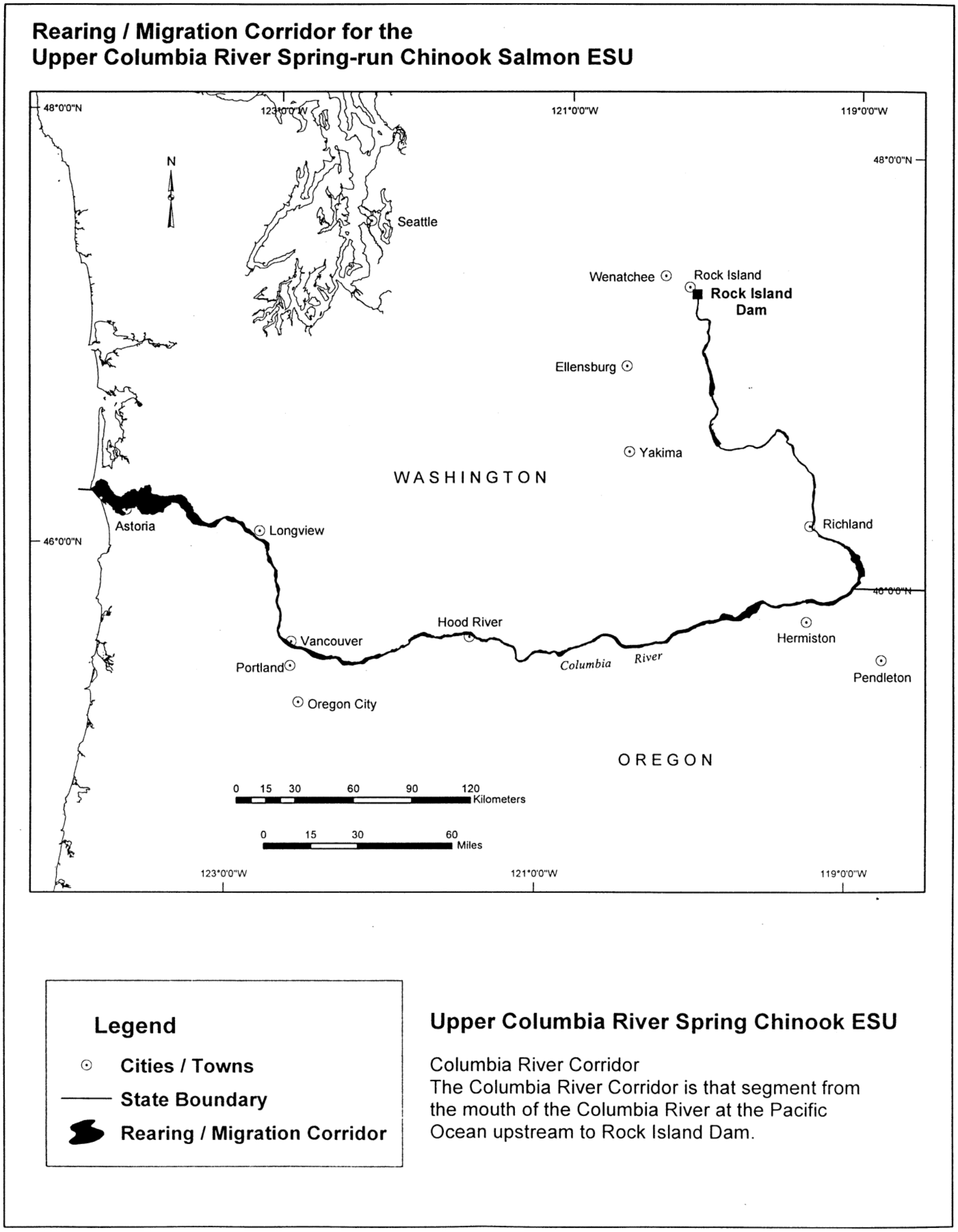

Figure 5. Upper Columbia River Spring-Run Chinook Salmon Critical Habitat (source: 70 FR 52630)

2.3 COLUMBIA RIVER BULL TROUT

On June 10, 1998, the USFWS listed the Klamath River and the Columbia River bull trout distinct population segments as threatened under the ESA (63 FR 31647). On November 1, 1999, the USFWS listed all bull trout in the coterminous United States as threatened (64 FR 58910). The USFWS completed a 5-year status review in 2008 that determined that no change in listing status was warranted (USFWS 2008). The Columbia River population segment is represented by relatively widespread subpopulations that have declined in overall range and numbers of fish. A majority of Columbia River bull trout occur in isolated, fragmented habitats that support low numbers of fish and are inaccessible to migratory bull trout. The few remaining bull trout ‘‘strongholds’’ in the Columbia River Basin tend to be found in large areas of contiguous habitats in the Snake River Basin of the central Idaho mountains, upper Clark Fork and Flathead Rivers in Montana, and several streams in the Blue Mountains in Washington and Oregon.

The USFWS published a final rule designating critical habitat for the Klamath River and Columbia River populations of bull trout on October 6, 2004 (69 FR 59996), and then again for the Klamath River, Columbia River, Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River populations on September 26, 2005 (70 FR 56212). The USFWS published revisions to the critical habitat designations in October, 2010 (75 FR 63898). The Mainstem Upper Columbia River Critical Habitat Unit 22 (Figure 6) includes the Columbia River from John Day Dam upstream 520.1 km (323.2 mi) to Chief Joseph Dam (75 FR 63898) and includes the Hanford Reach (Figure 7).

To be included as critical habitat, an area must provide one or more of the following three functions: (1) spawning, rearing, foraging, or overwintering habitat to support existing bull trout local populations; (2) movement corridors necessary for maintaining migratory life-history forms; and/or (3) suitable and historically occupied habitat that is essential for recovering existing local populations that have declined, or that is needed to re-establish local populations required for recovery (69 FR 59996). In its revised designation of critical habitat (75 FR 63898), the USFWS defined nine primary constituent elements necessary to sustain the essential bull trout life-history functions.

Segments of large rivers such as the Columbia and Snake Rivers are important to the conservation of bull trout because they are interconnected with tributaries that support bull trout and they provide important foraging, migrating, and overwintering (FMO) habitat. The mainstem Columbia River appears to provide essential FMO habitat for bull trout because of a combination of water depth, lower velocities, comparatively warmer water, and availability of food (69 FR 59996). Bull trout use of the Columbia River has been documented by radio-tagging studies conducted by the USFWS (69 FR 59996) and the Chelan, Douglas, and Grant County Public Utility Districts (Kreiter 2001, 2002; BioAnalysts, Inc. 2002 as cited in 69 FR 59996). Recoveries of tagged bull trout in the Bonneville Pool that originated from the Hood River have shown that bull trout are using the mainstem of the lower Columbia River as well (Wachtel 2000 as cited in 69 FR 59996). Radio-telemetry studies by the Oregon Department of Fish and Wildlife (Hemmingsen et al. 2001a, b) and Idaho Power Company (Chandler and Richter 2000 as cited in 69 FR 59996) have verified movements of bull trout between tributary streams and the mainstem Snake River. Current bull trout presence in the mainstem Columbia River reflects the strength of the local populations within tributaries and its value as a migration corridor (69 FR 59996). Adult migratory bull trout have been documented in the Columbia River primarily between October and May. Overwintering habitat is often only used seasonally, especially if an area has warm summer water temperatures that may cause bull trout to migrate to cooler areas (69 FR 59996).

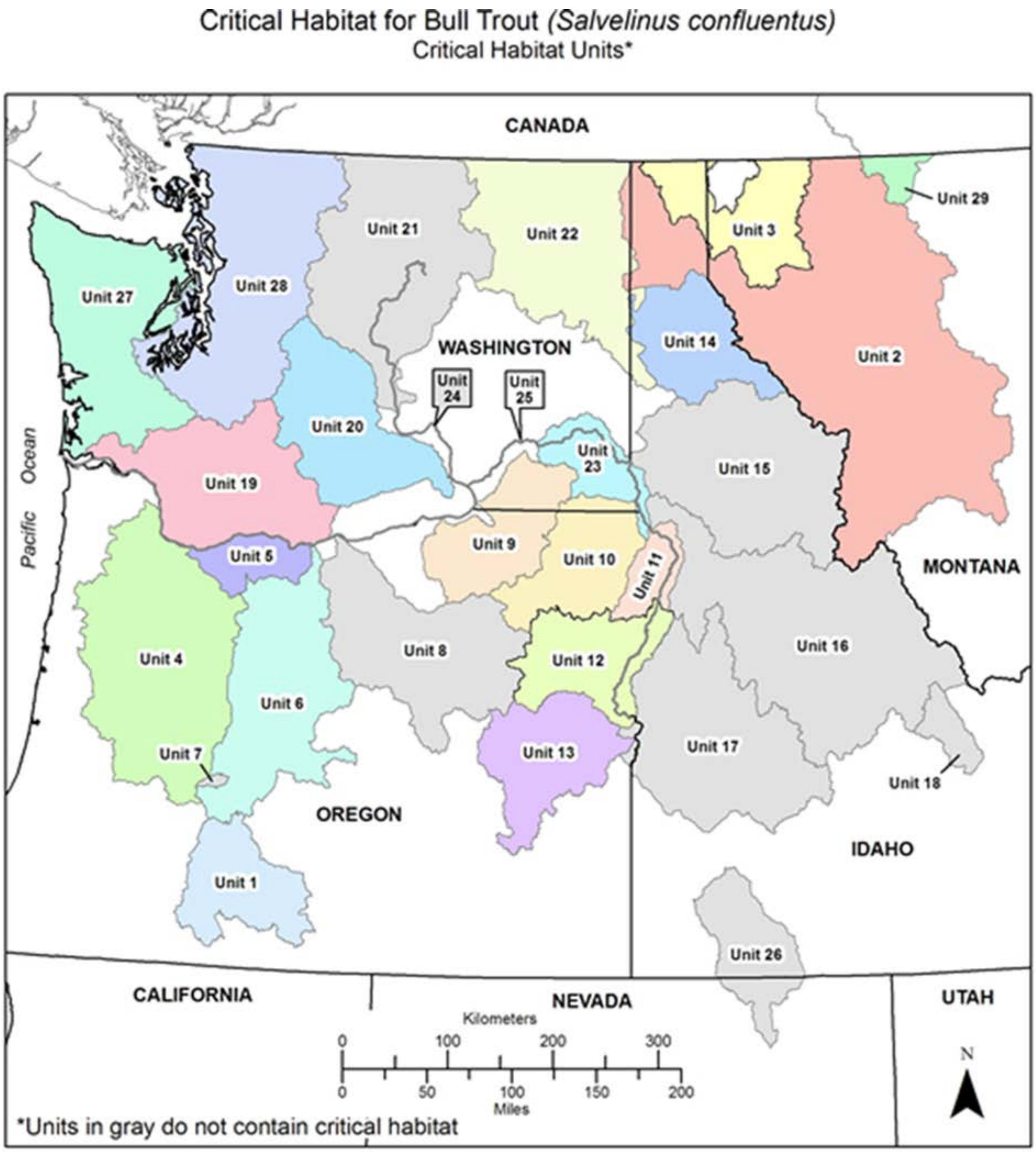

Figure 6. Bull Trout Critical Habitat Units (Source: 75 FR 63898)

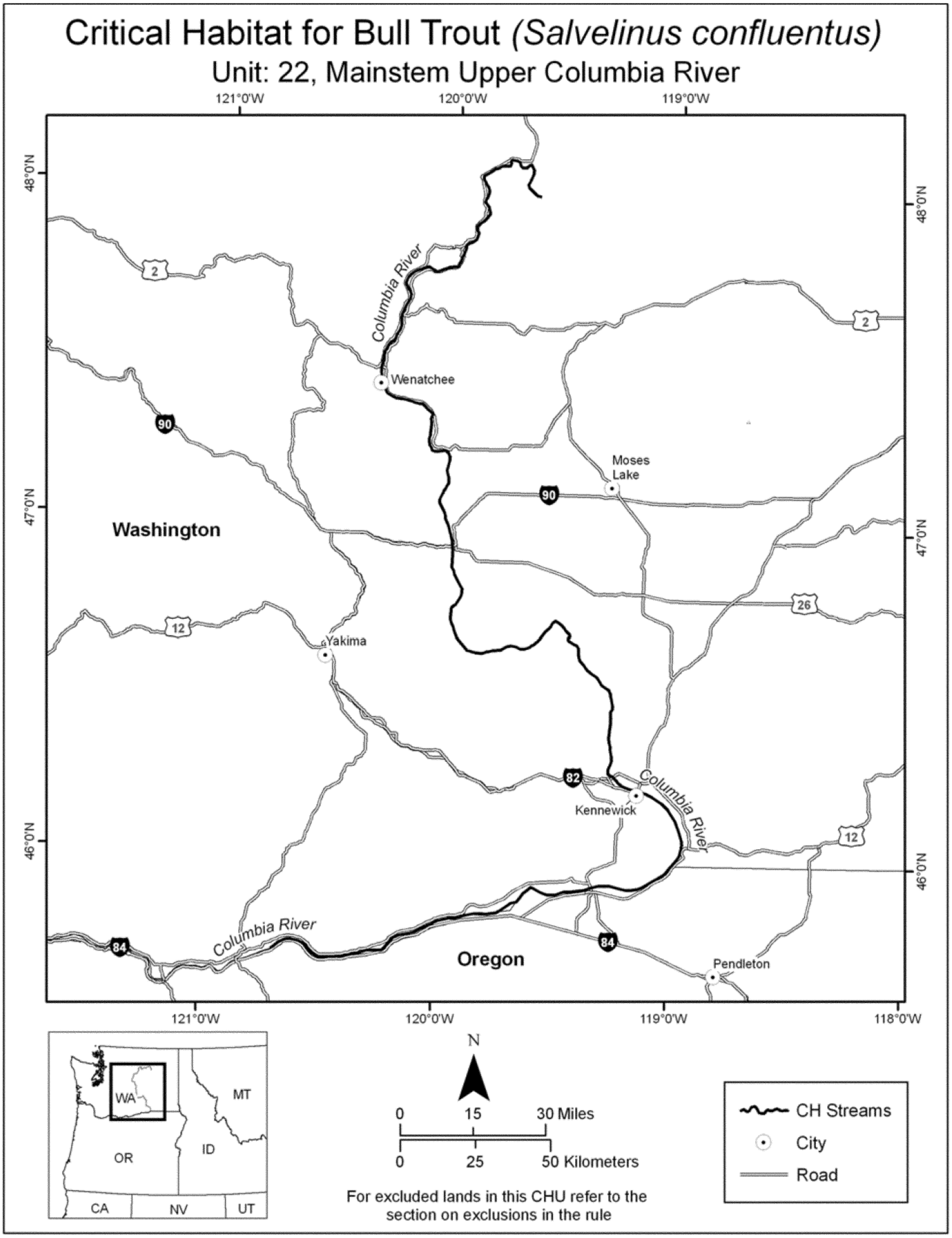

Figure 7. Mainstem Upper Columbia River Bull Trout Critical Habitat (Source: 75 FR 63898)

3.0 BIOLOGY OF LISTED SPECIES IN THE HANFORD REACH

3.1 UPPER COLUMBIA RIVER STEELHEAD EVOLUTIONARY SIGNIFICANT UNIT (ESU)

Steelhead are anadromous, meaning they live in the ocean but return to freshwater streams and rivers as adults to spawn. Most steelhead reside in the ocean 2 or 3 years and return to their natal stream/river as 4 or 5 year olds. Based on the timing of their entry as adults into the Columbia River, they are classified either as winter or summer run. Winter-run steelhead enter the Columbia River from November through April and spawn in tributaries below Bonneville Dam. Winter-run steelhead have not been found in the Columbia River system upstream of the Deschutes River (Peven 1990). Summer-run fish enter the Columbia River from May through October and spawn in areas above Bonneville Dam, including the Hanford Reach.

The proportions of hatchery and wild steelhead that return to the Hanford Reach are unknown. Ringold Hatchery (river km 570.5), operated by the Washington Department of Fish and Wildlife (WDFW), has been raising and releasing steelhead smolts into the Hanford Reach since 1962. From 1998 through 2011, these releases averaged 169,582 smolts (Hoffarth 2011). The annual adult sport catches in the Ringold area from 2001 through 2011 averaged 2,792 fish (Hoffarth 2011). With the exception of an 8-year time period (1981 through 1988), most fish reared and released into the Hanford Reach have been Skamania (coastal) steelhead, not the Wells stock that were listed under the ESA. Beginning in 1998, WDFW eliminated the release of the Skamania stock and switched to the Wells stock. This action was primarily in response to the listing of Wells stock steelhead under the ESA.

Unlike Chinook salmon, steelhead trout are iteroparous and can spawn more than once. However, the repeat spawning rate in the state of Washington is low (4 to 15% [Wydoski and Whitney 1979]), and adults encounter four mainstem dams on their way to and from the Hanford Reach. Repeat spawning in the Hanford Reach by a significant number of steelhead is unlikely.

MIGRATION

Steelhead are present in the Hanford Reach all year; however, most adults move into the Hanford Reach from August to November, peaking in September (Watson 1973; Becker 1985). Most steelhead that enter the Hanford Reach hold in the immediate vicinity for 6 to 8 months. A limited tagging study in 1967 found adults migrated near shorelines at depths less than 3 m (10 ft) (Coutant 1973).

Juvenile steelhead usually spend 1 to 3 years in freshwater before migrating downstream to the ocean (Shapovalov and Taft 1954; Chapman 1958; Maher and Larkin 1959; Peven 1990). Outmigration through the Hanford Reach usually occurs between April and June (Becker 1985). In addition to any fish produced within the Hanford Reach, this area also serves as an important holding and rearing area for yearling juvenile steelhead produced farther upstream. Fickeisen et al. (1980) estimated that between 2 and 2.2 million steelhead smolts may pass through the Hanford Reach each year. Yearling steelhead smolts (predominantly upstream hatchery stocks) have been collected mainly from the bottom, mid-channel zone of the river (Dauble et al. 1989). No juvenile steelhead were collected in shoreline fyke nets, but they were obtained in shoreline areas with electroshocking gear.

STEELHEAD SPAWNING WITHIN THE HANFORD REACH

Steelhead create redds (nests) in the gravel and cobble substrate of the river bottom. In Idaho's Clearwater and Salmon Rivers, the preferred gravel size for nesting has been reported as 1.3 to 10.2 cm (0.5 to 4 in.), water depth 0.2 to 1.5 m (0.66 to 4.9 ft), and water velocity 0.70 to 0.76 m/s (2.3 to 2.5 ft/s) (Orcutt et al. 1968); these habitat conditions also exist within the Hanford Reach.

Any spawning within the Hanford Reach most likely would occur between February and early June, with peak spawning in mid-May (Eldred 1970; Watson 1973; Becker 1985). Little is known about the quality and quantity of steelhead trout spawning, rearing, and adult holding habitat in the Hanford Reach. Watson (1973) estimated that from 1962 to 1971 an average of 35,000 steelhead trout that annually passed McNary Dam did not pass Priest Rapids Dam on the Columbia River or Ice Harbor Dam on the Snake River. He estimated that 10,000 of these fish were potential spawners in the Hanford Reach, after taking into account reductions due to migration into the Yakima and Walla Walla Rivers, sport catch, and natural mortality. Counts from 1977 to 1996 indicated an average of 20,000 steelhead trout that annually passed McNary Dam did not pass Ice Harbor or Priest Dams, and approximately 9,000 of these could potentially spawn in the Hanford Reach (Pacific Northwest National Laboratory, unpublished data). Gray and Dauble (1976) provide other evidence of steelhead spawning. They collected gravid and ripe females in late April and early May and collected spent males in August within the Hanford Reach.

The quantity and location of steelhead spawning in the Hanford Reach is often unclear because aerial surveys of steelhead spawning are difficult, due to high, turbid spring runoff that obscures visibility.

- Historical information on steelhead spawning in the Hanford Reach is available from the late 1960s and early 1970s during unusually low flow conditions (1,100 to 2,200 m^3/s [39,000 to 78,000 ft^3/s]– normal average flow is ~3,400 m^3/s [120,000 ft^3/s]). Key spawning areas reported from aerial surveys conducted in 1968 and 1970 included Vernita Bar, Coyote Rapids, Locke Island, 100-F islands, and Ringold (Tony Eldred, personal communication with D.R. Geist 9-28-89, see Figure 8). A total of 220 redds were counted in 1968 and 95 in 1970; total steelhead spawning was estimated by Eldred to be approximately 2,200 to 25,000 in 1968 and 950 to 7,800 in 1970. Fickeisen et al. (1980) indicated steelhead trout likely spawned at Vernita Bar, Coyote Rapids, Locke Island, and Ringold. An aerial survey conducted on April 30, 1998, identified up to 75 redds in the Hanford Reach, with the area from Wooded Island to Ringold having 14 redds and the 100-F islands having 61 (Dauble 1998). Much of the area at Locke Island where redds were counted in the 1970s has since been silted over due to slumping of the White Bluffs from agricultural water seepage.

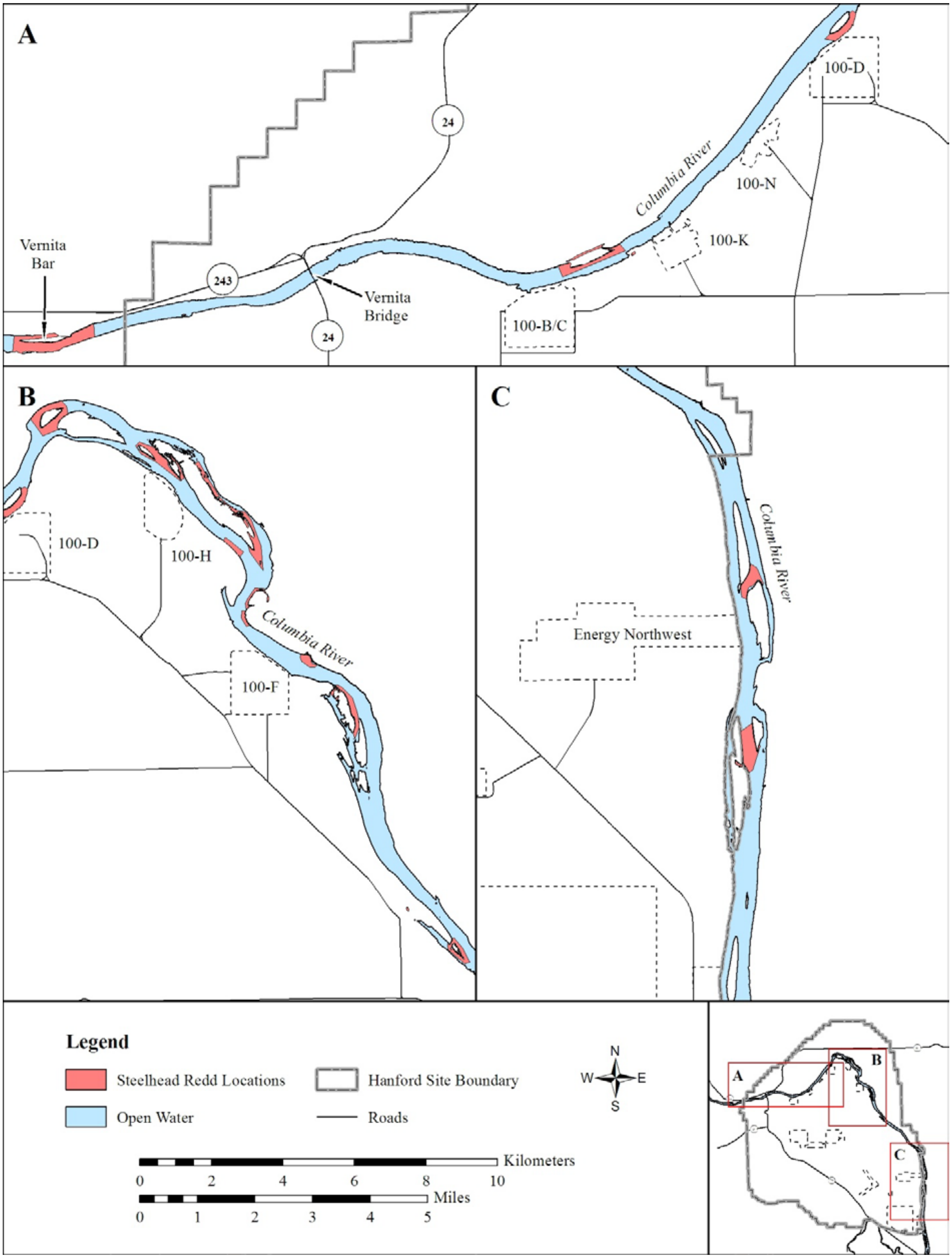

Figure 8. Locations of Steelhead Redds Observed During Aerial Surveys in 1968 and 1970 in the Upper Portion of the Hanford Reach (T. Eldred, personal communication September 28, 1989)

- More recent aerial surveys of steelhead have been performed in the springs of 1999 through 2002, 2004 through 2010, and 2012 through 2015 (MSA 2012, 2014). A comprehensive study also was conducted in spring 1999 to survey likely spawning areas near Locke Island, but no steelhead redds were found (Mueller and Geist 1999). Finally, the 100-N Area shoreline was investigated by aerial and boat surveys during spring 2005 to search for spawning areas (Poston 2010).

  Results of surveys conducted prior to 2015 show only limited spawning near the Ringold Hatchery Creek (near river mile 355) in certain years. One verified steelhead redd was also found near the 300 Area in spring 2003. The 2005 spring surveys identified a single location where steelhead redds occurred downstream of Ringold at Island 15 (Poston 2010). Aerial steelhead redd count survey data for years 2007 through 2009 resulted in the observation of only a single redd in 2008, which was located near the upper portion of Locke Island.

  During 2015, three aerial redd count surveys were performed during April and May. Using the maximum redd count seen at a particular location on either day, a total of 43 redds were identified in the Hanford Reach (MSA 2015). The higher number of redds is most likely due to the lower and more steady river flows experienced in 2015. Figure 9 shows the locations and numbers of steelhead redds observed in the Hanford Reach during the 2015 aerial surveys.

Figure 9. Steelhead Redds Observed in the Hanford Reach During the 2015 Aerial Surveys

HATCHING AND REARING

Steelhead eggs hatch in about 50 days when water temperatures are 10°C (50°F) (Wydoski and Whitney 1979). Fry emerge from the nest 2 to 3 weeks after hatching (Peven 1990). They school near the margins of the river and over shallow water gravel bars. Streamside vegetation and submerged cover are important habitat features for early life history stages because they provide protection from predators, moderate temperature, and colonization sites for steelhead food sources (Shapovalov and Taft 1954; Bustard and Narver 1975; Peven 1990). As fry grow larger they feed primarily on benthic organisms, including midges, mayflies, stoneflies, and beetle larvae (Wydoski and Whitney 1979). Macroscopic analysis of steelhead smolts collected in the Hanford Reach in 1974 and 1975 showed that fish were consuming adult caddisflies (53%), larval caddisflies (35%), and midgefly larvae (15%) (Gray and Dauble 1977).

If significant steelhead spawning does occur in the Hanford Reach, one would expect to find sub-yearling and pre-smolt juveniles (young-of-the-year). Gray and Dauble (1976) reported that young-of-the-year steelhead were not collected by small mesh beach seines in areas and at the time of the year when steelhead juveniles should have been present. Other studies have failed to collect young-of-the-year steelhead (Dauble et al. 1989; Wagner et al. 1997; Hoffarth et al. 1998; Nugent et al. 1999, 2000). In June 2001, four wild steelhead fry were collected from an entrapment pool near Wooded Island for the first time during the fifth year of an ongoing fry stranding study (Nugent et al. 2002). The absence of young-of-the-year steelhead noted in these studies may be due to low hatching success of steelhead eggs, low spawning abundance, or low catch per effort due to gear bias or sampling at the improper time or location. With few exceptions (Gray and Dauble 1976), many of the studies that reported a lack of young-of-the-year steelhead were not specifically fishing for them, but were targeting fall Chinook salmon instead. Steelhead eggs hatch later than those of fall Chinook salmon; thus, fry may not have emerged from the gravel at the time most fall Chinook salmon studies were conducted. Newly emergent steelhead fry are often found within submerged vegetation, which is not necessarily preferred habitat for juvenile fall Chinook salmon. Large beach seines used for fall Chinook salmon would not be effective in catching fish within vegetation. A summary of steelhead usage of the Columbia River within the Hanford Site is presented in Table 1.

Table 1. Life History Data for Upper Columbia River Steelhead within the Hanford Reach

	Life Stage						
	Return Migration	**Adult holdover in Reach**	**Spawning**	**Egg Stage**	**Intragravel development**	**Rearing**	**Outmigration**
Dates in Hanford Reach	Year round	1 September to 1 March	1 February to 1 June	1 February to 1 July	1 May to 15 July	Year round	1 April to 1 July
Food	None	Caddis larvae, midge larvae, zooplankton, adult insects, fish	None	Yolk Sac	Yolk Sac	Caddis larvae, midge larvae, zooplankton	Caddis larvae, midge larvae, zooplankton
Habitat	Pelagic - throughout water column	Pelagic - throughout water column	Gravels in mapped areas	Gravels in mapped areas	Gravels in mapped areas	Intermediate water (not main channel and not near shore)	Main Channel at night, nearshore feeding during day

3.2 UPPER COLUMBIA RIVER SPRING-RUN CHINOOK SALMON EVOLUTIONARY SIGNIFICANT UNIT (ESU)

The life history of Chinook salmon is complex and may vary depending on age at seaward migration; variation in length of freshwater, estuarine, and oceanic residence; ocean distribution and migratory patterns; and age and season of spawning migration (Healey 1991). Chinook salmon are similar to steelhead in that they too are anadromous and classified into runs based on when the adults return to their natal river to spawn. All three runs (spring, summer, fall) of Columbia River Chinook salmon ascend McNary Dam and return to and/or pass through the Hanford Reach (Becker 1985). Upper Columbia River Spring-Run ESU Chinook salmon are classified as a "stream-type" life history because the juveniles spend 1 or more years in freshwater before migrating to sea and return to their natal river several months prior to spawning (Healey 1991). Upper Columbia River Spring-Run ESU Chinook salmon are not known to spawn in the Hanford Reach. They do, however, pass through the Hanford Reach between April and mid-June on their way to spawning areas upstream (Table 2), traveling near the shoreline (Becker 1985; Peven 1990; Coutant 1973). Unlike steelhead, Chinook salmon, like most other Pacific salmon, are semelparous and die after spawning once (Healey 1991).

Table 2. Use of the Hanford Reach by Upper Columbia River Spring-Run ESU Chinook Salmon

	Life Stage				
	Return Migration	**Spawning**	**Intragravel development**	**Rearing**	**Outmigration**
Dates in Hanford Reach	1 April to 15 June	Above Reach	Above Reach	Above Reach	1 April to 1 September
Food	None	-	-	-	Caddis adults, midge adults
Habitat	Near shore	-	-	-	Main Channel at night, nearshore feeding during day

Juvenile spring-run Chinook salmon are released from hatcheries into the Hanford Reach. In 1982, 196,000 age-1 spring Chinook salmon from Leavenworth Hatchery were released below Priest Rapids Dam in the upper Hanford Reach. This was the only release of spring Chinook salmon directly into the Hanford Reach from stock originating upstream of the Hanford Reach in the last 30 years. From 1980 to 1998, the Ringold Fish Rearing Facility released an average of approximately 515,000 spring Chinook salmon per year (range 0 – 1,200,000) into the Hanford Reach. These releases comprised various stocks including Cowlitz (during the early 1980s), Klickitat, Carson, Yakima, and mixed stock returning to the Ringold hatchery. Although spring-run Chinook salmon are not known to spawn within the Hanford Reach, it is possible that a few hatchery fish have spawned in the river in the past. If this has occurred, these fish would not be classified as Upper Columbia River Spring-Run ESU Chinook salmon since the Hanford Reach is downstream of Rock Island Dam, the lower boundary of this ESU (63 FR 11482 and 64 FR 14308). At present, spring Chinook salmon are no longer released from Ringold Hatchery (Paul Hoffarth [WDFW], personal communication with Paul Wagner [Environmental Assessment Services] March 1, 2012).

Juvenile Upper Columbia River Spring-Run ESU Chinook salmon migrate downstream as smolts from April to September during their second year (Horner and Bjornn 1981; Becker 1985). Most migration takes place at night (Healey 1991; Mains and Smith 1955). Migrating smolts do not use nearshore habitat as do summer and fall Chinook salmon migrants, but instead, similar to outmigrating juvenile steelhead, exhibit a strong preference for the bottom of the mid-channel river zone (Becker 1985, Dauble et al. 1984, 1989). This results in their outmigration rates being more flow-dependent in relation to the other Chinook salmon runs. Period of travel from Priest Rapids Dam through the Hanford Reach to McNary Dam is estimated to be 3 days or less for active migrant spring Chinook salmon smolts (Table 2; Weitkamp and McEntee 1982). Backwater sloughs and shoreline indentations in the Hanford Reach may provide temporary foraging sites for outmigrating salmon (Becker 1973).

Adults reside in saltwater for 1 to 4 years and return to their natal stream/river as 4 or 5 year olds (Becker 1985; Mullan 1987; Peven 1990; Chapman et al. 1994).

3.3 COLUMBIA RIVER DISTINCT POPULATION SEGMENT BULL TROUT

Bull trout were once abundant throughout the Northwest and found in about 60% of the Columbia River Basin. Today, they occur in less than half of their historic range, with scattered populations in portions of Oregon, Washington, Nevada, Idaho, and Montana. Bull trout occur in 21% of their historic range in the Klamath River Basin, and no longer exist in California.

Bull trout are typically associated with the colder streams in a river system, although fish can occur throughout larger river systems (Fraley and Shepard 1989; Rieman and McIntyre 1993, 1995; Buchanan and Gregory 1997; Rieman et al. 1997 as cited in 64 FR 58910). For example, water temperature above 15° C (59° F) is believed to negatively influence bull trout distribution, which partially explains the generally patchy distribution within a watershed (Fraley and Shepard 1989; Rieman and McIntyre 1995 as cited in 64 FR 58910). Overwintering habitat, such as the mainstem Columbia River, often is only used seasonally until the water warms, and bull trout are forced to migrate out (69 FR 59996). Bull trout year-round use of the Hanford Reach is most likely precluded by summer water temperatures that typically range above 15° C (59° F) from late June through early October (Water Quality Monitoring Data, downstream from Priest Rapids Dam, 10-year average 2002 through 2011, [University of Washington 2012]).

Bull trout and Dolly Varden (*Salvelinus malma*) were previously considered a single species (Cavender 1978; Bond 1992 as cited in 64 FR 58910). Cavender (1978) presented morphometric (measurement), meristic (counts), osteological (bone structure), and distributional evidence to document specific distinctions between Dolly Varden and bull trout. Bull trout and Dolly Varden were formally recognized as separate species by the American Fisheries Society in 1980 (Robins et al. 1980 as cited in 64 FR 58910).

HABITAT

Bull trout are vulnerable to many of the same threats that have reduced salmon populations, but they have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993 as cited in 64 FR 58910). For example, the optimal temperatures for bull trout appear to be substantially lower than those for other salmonids (75 FR 63898). Besides very cold water (5° to 9° C [41° to 48° F]), bull trout require stable stream channels, clean spawning gravel, complex and diverse cover, and unblocked migration routes (Oliver 1979; Pratt 1984, 1992; Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Howell and Buchanan 1992; Rieman and McIntyre 1995 as cited in 75 FR 63898). In addition, large patches of these components are necessary to support robust populations. Further threats to bull trout include hybridization and competition with non-native brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), and lake trout (*Salvelinus namaycush*); overfishing; poaching; and man-made structures that block migration.

The decline of bull trout is primarily due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, impoundments, dams, water diversions, and the introduction of nonnative species (63 FR 31647 and 64 FR 17110). Climate change may exacerbate some of these impacts (75 FR 63898).

Bull trout spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992; Rieman and McIntyre 1993; Rieman et al. 1997 as cited in 64 FR 58910). Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide the necessary habitat requirements for bull trout spawning and rearing, and that the characteristics are not necessarily ubiquitous throughout watersheds in which bull trout occur. Because bull trout exhibit a patchy distribution, even in undisturbed habitats (Rieman and McIntyre 1993), fish would not likely occupy all available habitats simultaneously (Rieman et al. 1997 as cited in 64 FR 58910). Preferred spawning habitat generally consists of low gradient stream reaches often found in high gradient streams that have loose, clean gravel (Fraley and Shepard 1989 as cited in 64 FR 58910) and water temperatures of 5° to 9° C (41° to 48° F) in late summer to early fall (Goetz 1989 as cited in 64 FR 58910).

LIFE HISTORY

Bull trout exhibit both resident and migratory life-history strategies through much of their current range (Rieman and McIntyre 1993 as cited in 64 FR 58910). Resident bull trout complete their life cycles in the tributary streams in which they spawn and rear. Migratory bull trout spawn in tributary streams, and juvenile fish rear from 1 to 4 years before migrating to either a lake (adfluvial), river (fluvial), or in certain coastal areas, saltwater (anadromous) to mature (Fraley and Shepard 1989; Goetz 1989 as cited in 64 FR 58910). Anadromy is the least studied life-history type in bull trout, and some biologists believe the existence of true anadromy in bull trout is still uncertain (McPhail and Baxter 1996 as cited in 64 FR 58910). However, historical accounts, collection records, and recent evidence suggest an anadromous life-history form for bull trout (Suckley and Cooper 1860; Cavender 1978; McPhail and Baxter 1996; as cited in 64 FR 58910).

Spawning typically occurs in August to November when water temperatures drop below 9° C (48° F), in streams with abundant cold, unpolluted water, clean gravel and cobble substrate, and gentle stream slopes. Like steelhead, bull trout are iteroparous and may spawn more than once. Bull trout eggs require a long incubation period compared to other salmon and trout, hatching in late winter or early spring. Fry may remain in the stream gravels for up to 3 weeks before emerging.

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. Resident and juvenile bull trout prey on terrestrial and aquatic insects, macro-zooplankton, amphipods, mysids, crayfish, and small fish (Wyman 1975; Rieman and Lukens 1979 in Rieman and McIntyre 1993; Boag 1987; Goetz 1989; Donald and Alger 1993 as cited in 64 FR 58910). Adult migratory bull trout are primarily piscivorous, known to feed on various trout and salmon species (*Oncorhynchus* spp.), whitefish (*Prosopium* spp.), yellow perch (*Perca flavescens*), and sculpin (*Cottus* spp.) (Fraley and Shepard 1989; Donald and Alger 1993 as cited in 64 FR 58910). In the Willamette Basin, Chinook salmon are an important food source for bull trout. Adult bull trout are usually small, but can grow to 91 cm (36 in.) in length and weigh up to 14.5 kg (32 lb). Bull trout reach sexual maturity at between 4 and 7 years of age and are known to live as long as 12 years.

Migratory corridors link seasonal habitats for all bull trout life-history forms. The ability to migrate is important to the persistence of local bull trout subpopulations (Rieman and McIntyre 1993; Rieman and Clayton 1997; Rieman et al. 1997 as cited in 64 FR 58910). Migrations facilitate gene flow among local subpopulations if individuals from different subpopulations interbreed when some return to non-natal streams. Migratory fish may also re-establish extirpated local subpopulations.

PRESENCE WITHIN THE HANFORD REACH

The Columbia River population segment of bull trout includes 141 subpopulations, and the USFWS considers four geographic areas of the Columbia River Basin: (1) lower Columbia River (downstream of the Snake River confluence), (2) mid-Columbia River (Snake River confluence to Chief Joseph Dam), (3) upper Columbia River (upstream from Chief Joseph Dam), and (4) Snake River and its tributaries (including the Lost River drainage). The Mid-Columbia geographic area includes the Hanford Reach. Within this area, the USFWS has identified 16 bull trout sub-populations in the four watersheds (number of subpopulations in each watershed): Yakima River (8), Wenatchee River (3), Entiat River (1), and Methow River (4). Historically, populations of bull trout occurred in larger areas of the four tributaries and in the mainstem Columbia River. However, bull trout are thought to have been extirpated in 10 streams within this area, including the Hanford Reach. The USFWS also identified 3 subpopulations of bull trout within the Walla Walla River (Lower Columbia River geographic area) (63 FR 31647).

Bull trout have been documented both in the Rocky Reach, Rock Island, Wells, Wanapum, and Priest Rapids reservoirs (Bioanalysts Inc. 2004). Current information also suggests the occasional presence of bull trout in the Hanford Reach (Gray and Dauble 1977; Pfeifer et al. 2001). A bull trout radio-telemetry study conducted by Grant County Public Utility District in 2001 through 2003 found that *"only one of the 79 tagged bull trout migrated downstream past Wanapum Dam. This trout ultimately moved downstream through Priest Rapids Dam. This observation indicates that few bull trout migrate through projects owned by Grant County PUD"* (Stevenson et al. 2003).

Additional documentation indicates limited use of the unobstructed portion of the Columbia River between McNary and Priest Rapids dams. During the study years 2001 through 2004, Mahoney et al. (2006) did not observe migrating radio-tagged bull trout between the upper Walla Walla drainage and the Columbia River. However, one tagged bull trout was detected on January 31, 2007, moving downstream toward the Columbia River, which represents the first empirical evidence of Walla Walla Basin bull trout using the Columbia River (Anglin et al. 2009).

Bull trout are not likely to reside or spawn in the Hanford Reach, and those observations in the Hanford Reach are likely either displaced fish or migrating fish passing through the reach (Poston 2010). Fish passage data from hydroelectric projects immediately above (Priest Rapids Dam) and below (McNary Dam) the Hanford Reach support this. For example, from 2006 through 2011, only a single bull trout was observed (on July 17, 2007) migrating upstream from the Hanford Reach at the Priest Rapids Dam adult counting stations. Similarly, from 2001 through 2011, only 1 bull trout was observed (on December 21, 2004) passing upstream at the McNary Dam adult counting stations. Fish Passage Center data from 1998 through 2011 (Fish Passage Center website) indicate that bull trout were not sampled passing downstream through the juvenile collection system at McNary Dam, supporting the premise that juvenile bull trout hatch and remain to rear in cold headwater tributaries such as the Yakima and Walla Walla basins and likely do not use the mainstem Columbia River between McNary and Priest Rapids Dams for rearing.

Although the Hanford Reach may not have habitat suitable to support a subpopulation of bull trout year-round, mainstem portions of the Columbia River such as the Hanford Reach are known to provide essential FMO habitat where a combination of water depth, lower velocities, comparatively warmer water, and availability of food provide suitable habitat for at least a portion of the year (69 FR 59996). The Hanford Reach is critical habitat for bull trout based on its functionality as a migration corridor (Poston 2010). The mainstem Upper Columbia River Critical Habitat Unit is essential for maintaining bull trout distribution within the geographic region of the Mid-Columbia and conserving the fluvial migratory life history exhibited by many of the populations from adjacent core areas (75 FR 63898).

4.0 HANFORD ACTIVITIES POTENTIALLY AFFECTING LISTED SALMONIDS IN THE HANFORD REACH

This section describes the types of RL actions and facilities at the Hanford Site that could impact listed steelhead, spring Chinook salmon, bull trout, or their critical habitat within the Hanford Reach. It also notes which actions will have *no effect* on listed species or actions that *may affect, but not likely adversely affect* listed species or their habitats.

Threatened or endangered fish species in the Columbia River may be affected by Hanford operations in several ways. General categories of activities include:

- waste site remediation and facility demolition activities that occur near or within the river
- construction of new facilities near or within the river
- water withdrawals to support Hanford operations
- industrial or storm water discharges to the Columbia River
- groundwater remediation actions that may affect groundwater entering the river
- groundwater monitoring near or within the river
- other monitoring and research activities that may affect biota, water, or sediments
- pesticide applications near the river.

Each activity is described in greater detail below, and determinations regarding the potential effects of these actions on listed steelhead, spring-run Chinook salmon, bull trout, and their critical habitats are provided. When evaluating potential effects on bull trout critical habitat, RL considered each of the nine primary constituent elements defined in 75 FR 63898. The potential significance of many of these effects may depend on the particular setting where the action takes place. Therefore, RL has considered determinations based on whether the action takes place above the OHWM, on the shoreline between the OHWM and the edge of the river (wetted perimeter), or within the water. A summary of these effect determinations is provided in Table 3.

Table 3. RL Hanford Site Project Activities that Potentially Could Affect Listed Salmonids or their Critical Habitat

Activity Type	Effect Determination for Activities by Setting		
	Upland to OHWM	OHWM to Wetted Perimeter	In Water
Waste Site Remediation and Demolition	No Effect	May Affect, Not Likely to Adversely Affect	Further Consultation Required
Construction	No Effect	Further Consultation Required	Further Consultation Required
Water Withdrawals	N/A	N/A	May Affect, Not Likely to Adversely Affect
Permitted Waste Water Discharges	No Effect	No Effect	May Affect, Not Likely to Adversely Affect
Groundwater Monitoring	No Effect	May Affect, Not Likely to Adversely Affect	N/A
Groundwater Treatment	No Effect	May Affect, Not Likely to Adversely Affect	N/A
Environmental Research	No Effect	No Effect	May Affect, Not Likely to Adversely Affect
Pesticide Applications	No Effect	May Affect, Not Likely to Adversely Affect	Further Consultation Required

This section identifies various ongoing projects as well as planned or potential projects for the Hanford Site that could affect steelhead, Upper Columbia River Spring-Run ESU Chinook salmon, bull trout, or their critical habitats within the Hanford Reach. Activities are described at a level of detail necessary to determine the severity of potential impacts on these species. For planned or potential actions, information is provided to the level of detail possible at this time, which in many cases is at a relatively generic level. Each summary lists the potential impacts that need to be considered along with actions to mitigate those impacts. For all actions that fall within a generic *may affect, not likely to adversely affect* determination, RL will notify NMFS and/or USFWS prior to project implementation and RL will provide sufficient project description and analysis to allow the agencies to concur with the generic determination for that specific action.

Future projects with the potential to affect these species that are significantly different from the types of work defined here or fall outside the protection requirements described below will be coordinated with NMFS and/or USFWS, and RL will enter into formal or informal consultation, if needed, prior to taking actions that could affect these listed species or their critical habitats.

4.1 WASTE SITE REMEDIATION AND DEMOLITION

Waste site remediation on the Hanford Site generally consists of sampling and characterization, excavation and removal of soil, debris, concrete, followed by close-out sampling and backfill. Originally, many waste sites on the Hanford Site were near the river. These sites were associated with the reactor areas and the fuel production activities in the 300 Area and included both liquid and solid waste. RL prioritized remediation of sites along the Columbia River to minimize releases to groundwater and the river, so most of these sites have been remediated, interim closed-out, and are awaiting final records of decision under CERCLA. The majority of the waste sites remaining on the Hanford Site are located in the upland areas, well away from the Columbia River. Remediation at these sites, with approved storm water plans, is unlikely to cause any effects on listed salmonids or their habitats.

Several waste sites exist between the top of the floodplain and the OHWM. Although these projects occur outside of designated critical habitat, surface runoff could be considered an adverse risk to Upper Columbia River Spring-Run ESU Chinook salmon, steelhead, bull trout, or their critical habitat if runoff material results in the state water quality standards being exceeded or in siltation of, or the introduction of harmful contaminants to, a potential or known steelhead spawning area. Each project occurring along the shoreline with the potential for creating impermeable surfaces or destabilizing slopes will have an approved Stormwater Pollution Prevention Plan (SWPPP) in place to prevent potential impacts.

There also are a few identified waste sites remaining that extend beyond the OHWM of the Columbia River (Table 4), while others could be identified or reclassified at any time. Although final decisions have not been made for each identified location, some sites may be remediated while others may be left in place. Remediation designs are not available for these projects at this time, but designs will be thoroughly evaluated as part of the Ecological Compliance Review that is performed prior to the start of any project. Remediating these waste sites will remove the sources of contamination, if present, and thus prevent further movement of contaminants toward the river by groundwater.

The majority of these remaining sites consist of small segments of pipelines or spillways that extend from the upland area beyond the OHWM. Remediation of this type is expected to disturb less than 500 m^2 (5,382 ft^2) below the OHWM at a given site. However, some identified waste sites are associated with unplanned releases and dumping sites that extend over larger areas. For example, the current boundary of the 100-F-59 waste site is 6,000 m^2 (65,000 ft^2), all occurring below the OHWM but above the ordinary low water mark (OLWM). Remediation in these areas would be performed during seasonal low flows (August 1 through February), and would be conducted outside of the wetted perimeter of the river. RL will provide project-specific details to NMFS and USFWS as they are developed for concurrence. Any excavation that would impact the wetted perimeter of the river will require further coordination and/or ESA consultation with the respective agencies.

Table 4. Waste Sites that Extend Beyond the OHWM of the Columbia River and Their Current Status

Site Number	Site Name	Status
300-257	309 Process Sewer to River	Final - Closed Out
300 RLWS	300 Area Radioactive Liquid Waste Sewer, 300 Area RLWS	Inactive
300-15	300 Area Process Sewer System	Inactive
300-257	309 Process Sewer to River	Final - Closed Out
600-334	CMX Building	Final - Closed out
100-B-15	100BC River Effluent Pipelines, 100BC River Lines	Inactive
100-D-60	100D River Lines, 100D/DR River Effluent Pipelines	Inactive
100-D-65	116-D-5 Outfall Spillway, 1904D Spillway, 100-D-60:1 Flume	Interim – Closed Out
100-D-66	116-DR-5 Outfall, 1904-DR Spillway, 100-D-60:1 Flume	Interim – Closed Out
100-D-67	D Island, D Island Contamination	Interim – No Action
100-D-8	105-DR Process Sewer Outfall Site, 1907-DR, Undocumented Liquid Waste Site	Interim – No Action
100-D-50	100-DR Water Treatment Facilities Underground Pipelines	Inactive
100-F-39	100F River Effluent Pipelines, 100F River Lines	Inactive
100-F-59	Riparian Area Contamination Originating from 128-F-2	Inactive
100-H-34	100H River Effluent Pipelines, 100H River Lines	Interim – Closed Out
100-H-36	116-H-5 Spillway, 1904-H Spillway, 100-H-34:1 Flume (Spillway)	Interim – No Action
100-H-54	GPERS 100-H Shoreline Survey Unplanned Release	Interim – No Action
100-K-111	Effluent Seepage Area from 116-K-2	Inactive
100-K-113	100KW Columbia River Effluent Pipeline	Inactive
100-K-114	100KE Columbia River Effluent Pipeline	Inactive
100-K-80	100KW River Effluent Pipeline, 100KW River Line	Inactive
100-K-96	100KE River Effluent Pipeline, 100KE River Line	Inactive
100-N-104	Raw Water Overflow Spillway	Interim – Closed Out
100-N-77	River Line from 1908-N Outfall, 100N River Effluent Pipeline	Inactive
100-N-79	1908 N Outfall Structure, 1908-N Spillway, 100-N-77:1 Flume	Interim – Closed Out
100-N-80	River Line from 1908-NE Outfall	Inactive
100-N-84	100-N 100-N Miscellaneous Pipelines	Interim – Closed Out
100-N-102	100-N Potentially Contaminated French Drains	Interim – Closed Out
100-N-103	100-N Steam Condensate French Drains	Interim – No Action
100-N-61	100-N Water Treatment and Storage Facilities Underground Pipelines	Interim – Closed Out
100-N-62	100-N 105-N, 109-N, 163-N, 182-N, 183-N and 184-N Underground Pipelines	Interim – Closed Out
100-N-63	100-N Reactor (1314-N. 116-N-1 and 116-N-3) TSD Underground Pipelines	Interim – Closed Out
100-N-64	100-N Reactor 105/109-N Cooling Water Effluent Underground Pipelines	Interim – Closed Out
100-N-84	100-N 100-N Miscellaneous Pipelines	Interim – Closed Out
100-N-87	116-N Ventilation Stack Piping and French Drain	Interim – Closed Out
100-N-95	Hanford Generating Plant (185-N) Septic Tank	Interim – Closed Out
120-N-3	163-N Neutralization Pit and French Drain	Interim – Closed Out

Water flows in the Hanford Reach are controlled by upriver dams, thus the water levels can change rapidly due to dam operations. Therefore, it is possible during the course of a shoreline remediation project that river fluctuations could cause an excavation to become inundated, even if the project is performed completely during seasonal low flows. Because these activities will usually occur at a time when juvenile outmigrating salmonids are not expected to be present, the excavations are not likely to pose a stranding risk. Any excavation that extends beyond the OHWM must be left in a condition that prevents any potential stranding between mid-February and late-July (the period when stranding-prone juvenile salmon and steelhead may be present in the river).

Removal of native riparian vegetation will be minimized, and whenever possible, projects will be located in areas where vegetation is already disturbed. Damaged vegetation will be replaced with native plants for erosion protection and restoration. In all cases, the use of heavy equipment below the OHWM will be minimized. Wherever possible, such as in support or access areas, vegetation will be cut or mowed rather than grubbed or completely removed.

All fill material used below the OHWM will be in-kind to native shoreline materials (ancestral Columbia River cobble from local borrow sources). These materials are relatively free of fines and are relatively stable under current river conditions, and should result in minimal releases of sediment following completion of the shoreline projects and subsequent inundation by higher river levels. Any project that installs non-native substrate (such as basalt rip-rap), or installs permanent structures (such as retaining walls) below the OHWM, will require additional consultation with the respective agencies. Complex shorelines and riverbed features provide refuge for many life stages of salmonids, including emergent fry, yearlings, and adults. Project designs will maintain as much of the natural shoreline configuration as possible, and/or will incorporate mitigation measures into project design. Riverbank protection, when required for a given project, will use bioengineering rather than hard armor whenever possible. Projects will use accepted guidelines, such as Washington State Aquatic Habitat Guidelines Program, when designing streambank protection measures (WSAHGP 2002).

Waste site remediation actions that occur completely above the OHWM are expected to have *no effect* on listed species, assuming that best management practices (BMPs) are followed that prevent any run-off or impacts to the river or shoreline. Waste site remediation and supporting activities that are conducted below the OHWM, but outside the wetted perimeter of the river, will likely have a *may affect but not likely to adversely affect* determination regarding threatened or endangered species or their critical habitats. RL will notify NMFS and USFWS of these activities prior to implementation, and will supply sufficient project-specific information for the agencies to provide a concurrence with the generic determination. Any remediation activities that occur within water below the wetted perimeter of the river, or cannot be designed to meet all of the protective measures for shoreline protection, will require additional consultation with NMFS and USFWS to establish appropriate mitigation actions.

Demolition projects in upland areas occur frequently on the Hanford Site. When these activities are conducted with approved SWPPPs, *no effect* is expected to listed salmonids or their critical habitat. Any demolition activity that occurs below the OHWM, but outside of the wetted perimeter of the Columbia River, has the potential for impacting critical habitat. However, these projects will be conducted with approved SWPPPs, will follow BMPs, and will be followed by restoration using native materials. These projects will occur during low water periods, typically August 1 through February. Demolition projects performed below the OHWM but outside of the wetted perimeter *may affect but are not likely to adversely affect* listed salmonids and their critical habitats when conducted in this manner.

There are several structures remaining along the shorelines of the Columbia River, such as water intake buildings, that are expected to be removed in the future. Any demolition activities extending into the water will require further ESA consultation with the respective agencies.

4.2 NEW AND ONGOING CONSTRUCTION ACTIVITIES

Various construction activities on the Hanford Site could occur in the nearshore areas of the Columbia River, but above the OHWM. These may include, but not be limited to, infrastructure installation and maintenance activities that support the Hanford Site missions. Any new construction activities or ongoing activities will be conducted using BMPs and a SWPPP, which will ensure state water quality standards are not exceeded, and runoff does not occur near or affect a known or potential steelhead spawning area. These projects will also undergo an Ecological Compliance Review that will ensure that species or habitat impacts are avoided or mitigated; if the review determines that adverse impacts may occur, NMFS and USFWS will be contacted for further consultation. Construction activities performed in this manner are expected to cause *no effect* on listed salmonids or their critical habitat. No permanent structures will be installed along the shoreline below the OHWM without further ESA consultation with the respective agencies.

4.3 WATER WITHDRAWALS

Currently there are three permanent water pumping stations at RL facilities along the Columbia River with potential to impact juvenile fish. These are located at 100-B/C, 100-D, and 300 Areas.

181-B/C and 181-D Pumping Stations. These stations supply raw water from the Columbia River to the 200 East and West Areas and the other 100 Areas. Each of these pump stations contains several functional pumps, each capable of pumping approximately 631 L/s (10,000 gal/min). Current Hanford Site water use averages about 3,800 m^3/day (1,000,000 gal/day). To support this level of water use, two pumps at one of the facilities are activated for 3 to 4 hours every 2 to 3 days to maintain the water level in the raw water reservoirs located near each pump station. The screens at these pumping stations were installed in 1996, and have no moving parts, openings no greater than 1.75 mm (0.7 in), and an air backwash system to keep them free of debris. Water velocity through the screens is less than 0.1 m/s (0.3 ft/s). These screening systems meet the NMFS criteria for active screen systems (NMFS 2011b). Steel plates cover the pumphouse inlet channels to seal off openings between the pump house and the river.

300 Area Pumping Station. Fish screens at the 300 Area Pumping Station, which provides small amounts of raw Columbia River water to the 331 Aquatic Laboratory fish tanks, were evaluated and modified for compliance with WDFW requirements in 1995. Screen mesh size and approach velocity standards in 1995 (NMFS 1995) were similar to modern standards (NMFS 2011b).

In the past, divers were used periodically to clean intake screens, but this has not occurred in at least 10 years. If this were to occur in the future the process could create some disturbance to the riverbed. However, appropriate approvals or permits would be obtained prior to any in-water cleaning actions.

There are no new permanent water withdrawal systems planned for the Hanford Site. If a new system is proposed for installation, it will need to be reviewed, approved, and permitted by appropriate agencies such as WDFW, Washington Department of Ecology, and the U.S. Army Corps of Engineers. Native American Tribes may also be consulted before final designs are developed. The design of any new water withdrawal system would have to meet all the regulatory requirements and mitigation strategies for this type of activity. Any new water withdrawal systems will also include consultation with NMFS and USFWS under Section 7 of the ESA as part of the review process.

Minor withdrawals: Small-scale, temporary water withdrawals may be required to support specific projects. These withdrawals could be in the range of ten to several hundred gal/min, and would consist of a pipe placed in the river where needed. If such withdrawals are required, the pipe will have a screen that meets the current NMFS criteria for juvenile fish protection regarding pore size, approach velocity, and open area, and will be sized to account for the anticipated pumping rates. The site ecological compliance staff will work with these projects to identify locations for the withdrawal pipe and seasons when pumping can be accomplished with minimal impact to migrating or rearing juvenile salmon. The staff will work closely with NMFS and/or USFWS when needed to ensure adverse impacts are avoided. For instance, ecological compliance staff worked with NMFS to develop a means to safely withdraw water to support the Apatite Barrier project near the 100-N Area without harming juvenile salmon or steelhead (CHPRC 2010b). If any future minor withdrawals are needed, similar BMPs will be employed, and NMFS and USFWS will be notified prior to initiation of the withdrawal.

All existing water intake structures on the Hanford Site meet the NMFS criteria for protection of juvenile fish. The intake screens at the Site's primary intake structures have an active, air backwash cleaning system. None of the intake structures are located in steelhead spawning areas (Figure 8). Because all water intakes meet the current standards for the protection of juvenile fish and none are located near potential spawning areas, continued water withdrawal to support Hanford Site operations *may affect, but are not likely to adversely affect* listed salmonids. Although no new permanent withdrawals are planned, any new structures would require Section 7 consultation with the NMFS/USFWS.

4.4 PERMITTED WATER DISCHARGES

The EPA permits wastewater discharges to surface waters of the Columbia River under the National Pollution Discharge Elimination System (NPDES – 40 CFR 122). RL does not currently have any discharges to the Columbia River requiring an NPDES permit under the federal program. However, four

Washington Department of Ecology state waste discharge permits currently are in effect at the Hanford Site that allow releases of liquid wastes to the ground. The permits are for the 200 Area Effluent Treatment Facility (ST-4500), the 200 Area Treated Effluent Disposal Facility (ST-4502), Miscellaneous Streams (ST-4511), and the 200 West Area Evaporative Sewage Lagoon (ST-0045514). DOE is the holder of all state waste discharge permits.

Two Department of Ecology general permits for sand and gravel also are in effect: Concrete Batch Plant (WAG-50-5150) and Pit 30 Quarry (WAG-50-5181). These general state permits provide coverage for discharges of process water, storm water, and mine dewatering activities associated with sand and gravel operations and rock quarries.

Additional information about the Waste Water Discharge and Sand and Gravel permits can be found on the Washington State Department of Ecology website at http://www.ecy.wa.gov/programs/nwp/permitting/WWD/.

Any future permitted groundwater discharges on the Hanford Site would be expected to have *no effect* on listed salmonids or their critical habitats. Although expected to have minimal effect, permitted discharges to the Columbia River may affect the river environment, and would be assigned a *may affect, not likely to adversely affect* determination regarding listed salmon, steelhead, and bull trout.

RL does not currently anticipate the need for an NPDES permit. If such a need were to arise, RL would consult with NMFS and USFWS as part of the permit application and approval process.

4.5 GROUNDWATER MONITORING

Legacy wastes released to the soil have migrated through the vadose (unsaturated) zone and have reached the groundwater. Some contaminants have moved laterally with the groundwater as plumes to reach the Columbia River. The sources of these plumes are now-inactive waste or process ponds, ditches, cribs (similar to a sanitary septic tank), trenches, French drains, and various types of injection wells (also known as “reverse wells”). RL has taken steps to protect the Columbia River and groundwater by terminating all unpermitted discharges in the central Hanford Site, remediating the former liquid waste sites in the 100 and 300 Areas, containing groundwater plumes, and reducing the mass of primary contaminates through remedial actions such as pump-and-treat systems (DOE 2014).

Thousands of wells have been constructed on the Hanford Site since the early half of the 20th century beginning with early settlers drilling and hand digging wells for drinking water, to the drilling of wells to support the Site’s nuclear weapons production (starting in the 1940s), to the installation of wells for the Site’s environmental cleanup mission (starting in the 1990s). All known wells on the Hanford Site are tracked in the Well Information and Document Lookup database. Recognized well types include aquifer tubes, borings, groundwater wells, hosted piezometers, independent piezometers, piezometer hosts, soil tubes, lysimeters, and vadose wells (Table 5). Each well receives a unique Hanford identification number. A total of 12,030 wells have been assigned unique identification numbers as of the end of 2013, with 4,059 wells still in use. Wells currently in use include 2,960 groundwater and vadose wells, 122 piezometers within host wells, 79 lysimeters, 511 aquifer tubes, and

387 soil tubes. Of the 12,030 wells drilled, 7971 wells are candidates for decommissioning or have been decommissioned. All construction, maintenance, and decommissioning of wells on the Hanford Site are in accordance with Washington State provisions of WAC 173-160 (DOE 2014).

Table 5. Hanford Site Well Types (source: DOE 2014)

Well Category	Description
Aquifer Tube	A groundwater monitoring site installed along the river shoreline. Generally consists of a small diameter tube (less than one inch) and screen installed using push technology near the water table.
Boring	A borehole or direct push that was decommissioned immediately after drilling. Decommissioning generally would have been performed before the drill rig was removed from the site.
Groundwater Well	A well that is constructed with the open interval extending below the water table. This is the general case and should not be used if the site could be otherwise classified as an aquifer tube, piezometer, or piezometer host.
Hosted Piezometer	A groundwater monitoring well that is constructed inside of a host well. In most cases, hosted piezometers are one and one-half inch in diameter with the open interval extending below the water table.
Independent Piezometer	Small diameter, independent, groundwater monitoring well not constructed inside of a host well. In most cases, the independent piezometers are one and one-half inch in diameter.
Lysimeter	Generally an in-situ open bottom cylindrical core where the top is coincident with the ground surface, and with walls that prevent horizontal movement of moisture. A lysimeter is used to measure moisture or contaminant changes through time over a specific depth interval.
Piezometer Host	A well with one or more piezometers constructed inside it.
Soil Tube	Vadose zone monitoring site. A small diameter tube (less than two inches in diameter) and possibly a screen are left in place after the drilling is completed for sampling.
Vadose Well	A vadose zone monitoring site where casing (greater than two inches in diameter) is left in place after drilling activities are completed. May have a screen, open bottom, or may be closed.

In 2014, 977 wells and 324 aquifer tubes were sampled; many were sampled more than once for a total of 4,654 sampling events (DOE 2015c). Well monitoring follows a standard procedure. Before a sample is taken, wells are purged of a volume of water equal to three water columns. In accordance with Hanford Facility Dangerous Waste Permit, Revision 8C, Permit Number WA7 89000 8967, if contaminated (higher than permit criteria) purge water is generated, it is contained in tanker trucks and sent for disposal. Non-contaminated purge water may be discharged to the surrounding ground surface. No contaminated water is discharged on the ground, and no water is discharged directly to the river.

In addition to routine sampling, occasional hydrologic testing is performed to characterize the aquifer. This involves pumping water from the well continuously for several days. This is only done a few times per year and rarely on the wells near the river. Strict procedures and BMPs are followed to prevent erosion and all discharges are performed in accordance with the Hanford Site Miscellaneous Streams Discharge Permit (ST-4511). Except as authorized by a wastewater discharge permit, no discharge or runoff of wastewater is allowed to any surface waters, including the Columbia River. Well installation and decommissioning are routine activities that will continue to occur at Hanford for the foreseeable future. During 2014 RL completed 30 new wells and aquifer tubes for monitoring, remediation, and characterization and decommissioned 4 wells that were no longer needed (DOE 2015c). Some of these activities may occur within the 100-year floodplain. Permanent wells will not be installed below the OHWM, but boreholes or other temporary wells may be constructed for aquifer or substrate characterization. The physical impact to the environment from these activities is generally minor because of the small area affected.

Drilling a new well often involves clearing and/or leveling an area large enough for the drill rig and support equipment (typically 600 m^2 [6,500 ft^2]). The size of the area can vary, depending on the type of drilling equipment used. The quality and sensitivity of the habitat in the area also influences the size of the drill pad. Where high quality or sensitive habitat, including riparian or sagebrush steppe is present, all efforts are made to keep the area of disturbance as small as possible. RL evaluates each proposed project and identifies requirements that will minimize disturbance to high quality or sensitive habitats or to protected species (DOE 2013b).

Well decommissioning consists of bringing in equipment either to pull the well casing or perforate it, fill it with grout to the surface, and then restore the pad with native vegetation. Decommissioning wells generally disturbs less area than installing them because clearing and leveling the land surface is seldom required. Land disturbance from this activity is often only from vehicle tracks.

Groundwater entering the Columbia River is monitored by installing small-diameter tubing in the shoreline to various depths (aquifer tubes). Access to these sites may be by driving a vehicle to the shoreline, when accessible, but is commonly by boat. The installation typically involves driving a 2.5- to 3.75-cm-(1- to 1-5 in.) diameter steel tube up to 10 m (30 ft) deep, along with an inner plastic sample tube, into the gravels using either a truck-mounted hydraulic ram or a hand-operated air-driven ram. Once the desired depth is reached, the outer casing is removed, leaving the 0.6-cm (0-24 in.) diameter sample tube in place. Sample tube locations are below the 100-year flood plain and generally just above the annual low-water shoreline. Installation usually takes place above the active waterline during the months of lowest river flow (August to November), but may occur in up to several feet of water. The sample tubes typically extend well above the water line, often to above the OHWM. Thus, sampling usually can be conducted with minimal in-water disturbance.

The impacts from aquifer tube monitoring on shoreline habitat are considered to be minimal, consisting of temporary disturbance to vegetation by foot traffic and occasionally by driving a vehicle to the shoreline (only done in areas that are accessible). No excavation is conducted and no permanent damage is done to vegetation.

Most groundwater monitoring activities occur above the OHWM and are expected to cause *no effect* on listed salmonids or their critical habitat. Activities that occur below the OWHW but above the OLWM *may affect but are not likely to adversely affect* listed salmonids or their critical habitat. RL will notify NMFS and USFWS prior to installation of any new groundwater monitoring devices or wells below the OHWM, and will provide sufficient information for the agencies to concur with the generic determination regarding these impacts.

4.6 GROUNDWATER TREATMENT

RL is using several techniques of groundwater treatment to reduce the amount and extent of contaminants reaching the Columbia River. These techniques include pump-and-treat systems, in-situ groundwater treatment, and permeable barriers.

Pump-and-treat systems consist of a set of groundwater wells designed to clean up groundwater contamination. Wells are installed down gradient of a contamination plume to pump the water out of the ground. In the case of systems adjacent to the Columbia River, the groundwater is treated to remove contaminants, and is then re-injected upgradient of the plume. These wells are not within the 100-year floodplain; therefore, shoreline habitats are not affected. Although treated groundwater will eventually reach the Columbia River, the result will be an improvement of water quality entering the river. Currently, there are five pump-and-treat systems operating on the Hanford Site within 2 km (1 mi) of the Columbia River and additional systems in the 200 West Area. There are three pump-and-treat systems (KR-4, KX, and KW) in the 100-K Area with 42 extraction wells and 18 injection wells capable of treating 4.6 million liters (1.2 million gallons) of groundwater per day and two pump-and-treat systems (DX and HX) between the 100-D and 100-H Areas with 68 extraction wells and 29 injection wells capable of treating 7.6 million liters (2 million gallons) of groundwater per day depending on the season.

A permeable reactive barrier (also known as the In-Situ REDOX Manipulation Project) was installed in the 100-D Area for in-situ chemical treatment of hexavalent chromium. The barrier was designed to intersect the portion of the groundwater plume with highest concentration of hexavalent chromium. The treatment area, which is approximately 680 m (2,250 ft) long with 65 wells, was injected with sodium dithionate ($Na_2O_6S_2$), which reacts with the metal in the sediments creating a reducing zone. As groundwater moves through this zone, hexavalent chromium is reduced to trivalent chromium. The trivalent chromium precipitates out and is thus prevented from migrating to the river. The project was implemented to prevent the continual discharge of hexavalent chromium to the river where it may impact aquatic organisms, including salmonid eggs and fry. The treatment makes the groundwater anoxic, but a numerical model predicts 75 to 95% oxygen saturation at the river. Air entrapment caused by water table fluctuations has the most impact on dissolve oxygen concentration (Williams et al 1999). No fall Chinook salmon spawning occurs where groundwater from the treatment area enters the river and less than one percent of the area is suitable spawning habitat (Mueller and Geist 1998). In 1999 RL transmitted a BA that determined that there would not be a significant impact to listed salmon or steelhead (DOE 1999b). In 2010, due to breakthrough of contaminants at the barrier, it was decided that the barrier would no longer be actively maintained and that expansion of the pump-and-treat system (i.e., extraction wells located down gradient of the barrier) would be used to address the breakthrough and provide a protective interim remedy.

A 311-m (1,020-ft) permeable reactive barrier for strontium-90 is located in the 100-N Area. Strontium-90 is sequestered by injecting calcium-citrate phosphate solution into the aquifer. Biodegradation of the citrate results in apatite precipitation as the free calcium and phosphate combine to form apatite. Strontium (and strontium-90 ions) in groundwater substitute for calcium ions through cation exchange and are incorporated in the mineral matrix during apatite crystallization. RL recently expanded this barrier to a length of 762 m (2,500 ft). The potential impacts of the 100-N apatite barrier on salmonids evaluated by Poston (2010) identified increased cation concentrations and dissolution of metals as the primary potential impacts. It was determined that factor was likely to have a detectable effect on migrating juvenile salmon or steelhead.

Most recently, a system designed to sequester uranium present in the soil and groundwater beneath a portion of the 300 Area was constructed. Uranium sequestration involves infiltrating/injecting phosphate solutions to the vadose zone and periodically rewetted zone to sequester, or bind, residual mobile uranium to form insoluble minerals. Uranium sequestration will also be used in the top of the aquifer to reduce the mobility of uranium that may be mobilized during the vadose zone treatment process. Uranium sequestration is anticipated to reduce the mass of soluble uranium entering the groundwater in this area, thereby reducing the restoration time frame for uranium in the groundwater. Uranium in the groundwater will be monitored until cleanup levels are met. The potential impacts of the uranium sequestration project on the three ESA-listed salmonids and their critical habitat were evaluated in support of informal consultations with USFWS and NMFS (DOE 2015b).

In addition, RL has constructed a bioventing system for in-situ bioremediation of deep vadose zone petroleum contamination in the 100-N Area. Bioventing is a process in which oxygen is added by forcing air through vadose zone soils to enhance the population of naturally occurring bacteria to metabolize and remove petroleum contaminants from the vadose zone. Petroleum contamination in the aquifer is being removed using a polymer “smart sponge” that selectively absorbs petroleum products from the groundwater within the wells observed to have a free-floating petroleum product; currently this is performed at only one well. RL is proposing to use biosparging to further address petroleum contamination in the aquifer. Similar to bioventing, biosparging will force air into the aquifer to enhance the population of naturally occurring bacteria in the aquifer to metabolize petroleum contamination in the aquifer.

Operation of groundwater treatment systems will benefit the Columbia River ecosystem by improving the quality of the groundwater entering the river. Groundwater treatment activities occur above the OHWM and are expected to cause *no effect* on listed salmonids or their critical habitat.

4.7 ENVIRONMENTAL RESEARCH

Environmental research is conducted to monitor the distribution of radionuclides and other contaminants in the environment, and to perform research on various biotic, abiotic, and cultural resource concerns. This activity consists of various types of biotic and abiotic sampling along with ecological evaluations and data gathering. Sampling supports contaminant characterization in river sediments or in the porewater below the surface of the riverbed.

Abiotic sampling inside the wetted perimeter of the river includes surface water, sediment, and porewater samples. Samples are obtained with jars or scoops, small pumps, small ponar samplers, seep samplers, aquifer tubes, or substrate probes. Sampling may take place on exposed shorelines when water levels are at a daily or seasonally low point or within submerged portions of the river. Seep samplers are installed by digging shallow (<1-m [3-ft]) holes in exposed shoreline areas to bury tubes, aquifer tubes are placed in the shoreline substrate up to 10 m (30 ft) deep using a hydraulic hammer, while substrate probes are placed into the river bottom using a weighted frame. Care will be taken during all sampling activities to not leave depressions where juvenile salmon or steelhead could become stranded. These sampling activities are not expected to impact habitat integrity because very small sample quantities are collected on an intermittent basis.

Water, sediment, and shoreline sampling/monitoring activities will occur on a sporadic and intermittent basis. These activities include small volumes of water (usually <20 L [5 gal]) and small masses of sediment (<2 kg [4.4 lb]). These activities are not expected to result in significant levels of harassment due to their short term and sporadic occurrences. When these sampling activities are conducted outside of the wetted perimeter of the river, *no effect* on listed salmonids or their habitats are expected. When sampling will occur in the water, fish may be temporarily displaced due to noise disturbance associated with sampling devices. These disturbances are likely to have minimal effect on listed species or their habitats.

Selected fishes are routinely collected, usually by electrofishing or hook-and-line, throughout the Hanford Reach for various research purposes and for contaminant uptake monitoring. Other organisms, such as invertebrates and amphibians, may be surveyed or sampled to support ecological characterization and contaminant monitoring. Electrofishing will be conducted consistent with NMFS Electrofishing Guidelines (NMFS 2000). Hook-and-line sampling will be conducted primarily with artificial lures and in target species habitats. The use of natural bait will be minimized and only used as necessary to collect the desired number of target specimens when other techniques fail. The activities described above will only be conducted in accordance with Section 10 Incidental Take permits and WDFW Scientific Collection permits. Consequently, no unpermitted take/harassment of listed salmonids will occur during fish sampling activities.

Mitigation strategies for water/sediment sample collection will include avoiding critical times of the year and sensitive habitats such as spawning areas. Environmental monitoring activities will not be conducted in known spawning areas for steelhead (Figure 8) during the spawning period, until the point that spawning activity is documented as absent during aerial redd counts. RL performs annual aerial surveys for steelhead redds during May and June. If steelhead redds are located during the course of these surveys, protective measures will be put in place to minimize boat activities and avoid sampling in those areas. No sampling will occur within 10 m (30 ft) of a fall Chinook salmon redd. In addition, the general strategies developed to prevent capture, harassment, or impacts from riverbed modifications will prevent any adverse effect on steelhead, Upper Columbia River Spring-Run ESU Chinook Salmon, or bull trout or their critical habitats from sampling and ecological evaluation activities. Adherence to stipulations included in the required WDFW Scientific Collection Permit, and subcontractors ESA Section 10 Incidental Take Permits, will mitigate for impacts associated with fish collection.

Environmental sampling and monitoring activities are usually small-scale and short-duration actions. These activities are likely to cause noise at an intensity of <150 dB, and therefore are unlikely to cause physical injury to listed salmon, steelhead, or bull trout that can occur from other actions such as pile driving (Hastings 1995; NMFS 2012). The noise from boats used for access to sample and monitoring locations may have small, short-term behavior effects on listed fish species (NMFS 2012), but the amount of boat traffic due to Hanford-related environmental sampling and monitoring is expected to be relatively small compared to the typical daily recreational boat traffic on the Hanford Reach.

Environmental research activities that occur outside of the wetted perimeter of the Columbia River are expected to have *no effect* on listed salmonids or their critical habitat. Environmental research activities that occur within the wetted zone of the river *may affect, but not likely to adversely affect* listed salmonids or their critical habitat. In 2008, NMFS concurred with this determination (NMFS 2008) and reaffirmed the determination in 2013 (NMFS 2013c).

4.8 PESTICIDE APPLICATIONS

Pesticide applications are occasionally used to control noxious weeds on the Hanford Site. All applications are performed by state-licensed applicators following procedures and application requirements defined specifically by EPA for each product. All upland noxious weed control applications will be performed under conditions that will not result in any runoff or drift to the Columbia River environment.

When pesticides are applied above the OHWM, label instructions are followed and appropriate buffer distances are established to ensure that the chemicals do not drift to the river. Therefore, pesticide applications above the OHWM are expected to have *no effect* on listed salmonids.

Historically, pesticides have not been applied in the Columbia River or in adjoining riparian areas. However, products that are EPA-approved specifically for application in aquatic environments potentially could be considered by RL to control noxious weeds in the nearshore environment. Application of EPA-approved pesticides below the OHWM that follow label instructions *may affect, but* *are not likely to adversely affect* listed salmonids. NMFS is currently consulting with EPA concerning a number of pesticides, and RL will monitor these discussions. If pesticide applications within or near the river are pursued, RL will carefully evaluate and select products based on their potential toxicity to salmonids, and will consult with NMFS and/or USFWS prior to application below the OHWM. Any deviations from these requirements will necessitate consultation with NMFS/USFWS prior to application.

5.0 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

Federal agencies are directed, under 305(b)(2) of the Magnuson-Stevens Act to consult NMFS regarding actions that are authorized, funded, or undertaken by that agency that may adversely affect EFH, defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The Hanford Reach provides habitat for various life stages of Chinook and coho salmon and steelhead, and hosts the major spawning aggregation of Upper Columbia River bright fall-run Chinook salmon.

Most actions conducted by RL and its contractors occur in the terrestrial environment above the OHWM and are not expected to impact EFH. Mitigation methods that include silt fences, grading to prevent runoff, and project timing for actions close to the OHWM will prevent impacts to EFH. For any actions that occur between the OHWM and the wetted shoreline, RL and its contractors will take additional measures to avoid impacts to EFH, including monitoring the condition of the riparian vegetation and reestablishing native plants as necessary. Rearing juvenile fall Chinook salmon are highly associated with the nearshore environment and are vulnerable to stranding.

Best management practices to minimize impacts to EFH for fall Chinook and other anadromous salmonids include the following:

- All work occurring between the OHWM and the wetted shoreline will be performed during the low flow season (generally August 1 through February), a timeframe that falls outside of the emergence and rearing period for juvenile fall Chinook salmon.
- Any excavation that extends beyond the OHWM must be left in a condition that prevents any potential stranding while juvenile salmonids are present (between March and July).
- Any excavation work will include runoff prevention and restoration to re-establish native vegetation and to prevent soil erosion.
- Any fill material will be in-kind native shoreline materials from local sources.
- No in-water work will be performed by RL and its contractors without further consultation with NMFS.

These mitigation measures will substantially reduce impacts to EFH.

6.0 MANAGEMENT PLAN IMPLEMENTATION

This management plan is implemented primarily through the National Environmental Policy Act (NEPA) review process and the analogous CERCLA Remedial Investigation process. One aspect of these review processes is the Ecological Compliance Review, which evaluates proposed projects against regulatory criteria and RL natural resource management goals. Ecological compliance reviews for all projects with the potential to affect listed species or the Columbia River will include a consideration of these requirements and management procedures. These requirements and procedures pertain to RL and its contractors as they perform work under their operations contracts with RL.

RL's *Hanford Site Biological Resources Management Plan* (BRMP) (DOE 2013b) provides objectives and strategies for biological resource protection, monitoring, assessing impacts, and determining mitigation requirements for Hanford Site activities. BRMP-related monitoring may include annual spawning surveys, habitat evaluation, and contaminant monitoring. RL projects are required to rectify or replace all riparian habitats that are disturbed by RL Projects. Riparian areas and the Columbia River are among the habitats with the highest priority for protection.

RL abides by the belief that protecting habitat is a more cost-effective and prudent approach to resource management than restoring habitat that is lost or damaged. Therefore, every effort will be taken to ensure that RL and its contractors conduct activities in a manner that is protective of salmon, steelhead, and bull trout habitat. This includes following project-specific best management practices and considering the objectives of this plan in land management decision-making.

When possible, activities will be conducted during time periods or at places that avoid contact with steelhead, bull trout, and salmon. Good planning and construction practices will be used to minimize impacts to listed salmonids. For example, properly maintaining equipment to prevent loss of petroleum products, using erosion and sediment control measures, and disposing of construction debris in upland locations will prevent degradation of water quality. Where possible, contractors will incorporate provisions into their project plans that are beneficial for fish and wildlife habitat.

Future projects with the potential to affect these ESA-listed species that are significantly different from the types of work defined in this document will be coordinated with NMFS and/or USFWS, and RL will enter into formal or informal consultation, if needed, prior to taking actions that could affect these listed species or their critical habitats.

7.0 REFERENCES

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