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

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

P.O. Box 550
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited
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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’ (RL) commitment to protecting the stocks of Upper Columbia River spring Chinook salmon (*Oncorhynchus tshawytscha*), 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 United States Fish and Wildlife Service (FWS) 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 (MSA) and its implementing regulations, to consult with NMFS regarding actions that agency authorizes, funds, or undertakes that may adversely affect Essential Fish Habitat (EFH). This plan constitutes a partial consultation between the RL and both NMFS and FWS as partial fulfillment of RL’s responsibilities under the ESA and the MSA.

The Hanford Site comprises 1,450 km² (560 mi²), 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 km² (305 mi²) area designated as the Hanford Reach National Monument in 2000. RL is the landowner over the entire Hanford Site, although portions of the Monument are managed by FWS.

Steelhead are present in the Hanford Reach all year. Most adults move into the Reach from August to November, where they may reside for 6 to 8 months near shorelines at depths less than 3 m. 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 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 temperature, and provide colonization sites for steelhead food sources. As fry grow larger they feed primarily on food associated with the bottom of the river, including midges, mayflies, stoneflies, and beetle larvae.

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

Bull trout require colder water than all other Columbia Basin salmonids, and they generally reside and spawn in smaller streams at higher elevations. Therefore, their presence on the Hanford Reach is most likely limited by relatively warm summer water temperatures. However,
there is limited evidence confirming occasional bull trout presence on the Hanford Reach. The Hanford Reach is included in the critical habitat designated for bull trout based primarily on its functionality as a migration corridor. It is believed to be used primarily for foraging, migration, or overwintering by migratory bull trout. The mainstem upper Columbia River Critical Habitat Unit, which includes the Hanford Reach, 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.

RL 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 for these activities in this Management Plan, none of the planned actions or potential effects is likely to adversely affect the listed salmonids within the Hanford Reach, nor will they modify critical habitat.

To ensure protective management of these listed species, RL will ensure that RL and its 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 following best management practices and designing and implementing projects to meet the following criteria:

- RL will avoid adverse impacts due to water withdrawal by reducing the magnitude of water withdrawal from existing intakes, when possible, and ensuring that all water diversions meet the State of Washington and NMFS screening criteria, or meet appropriate administrative controls, such as the timing of withdrawal.

- All material discharged to the Columbia River will comply with existing National Pollution Discharge Elimination System (NPDES) permits. To ensure that no impacts to listed species occur, no material will be discharged near steelhead spawning areas even if it meets the NPDES permit requirements. NMFS and FWS will have opportunity to review and comment on any new NPDES permits for the Hanford Site.

- The use of heavy equipment below the ordinary high water mark (OHWM) will be minimized. When heavy equipment use 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 take place below the OHWM without additional consultation with NMFS and/or FWS.

• 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. 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.

• Riverbank protection, where required for a given project, will use bioengineering rather than hard armor whenever possible. Projects will utilize accepted Washington Department of Fish and Wildlife guidelines when designing streambank protection measures, and RL will consult with NMFS and FWS 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 activities will be minimized by avoiding impacts to shoreline vegetation and utilizing 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, but above the wetted perimeter, RL will attempt to 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, nor will activities be conducted that would adversely modify critical habitats (the Columbia River and its riparian zone) or essential fish habitat as defined in the MSA without specific consultation with NMFS.

• No activities that could result in capture or harm to bull trout will be conducted without undergoing consultation with FWS, nor will activities be conducted that would adversely
modify critical habitat (the Columbia River and its riparian zone) without specific consultation with FWS.

If Hanford Site activities are carried out in accordance with this plan, they are not likely to have a significant effect on 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 in this plan will most likely not require formal or informal consultation with NMFS or FWS. However, RL will coordinate with these agencies prior to project implementation and will provide the agencies with sufficient information to determine that this plan and the 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 of the potential actions described in this plan, as well as any activities performed not in accordance with this plan, or not described in this plan, will require formal or informal (whichever is appropriate) consultation with the NMFS and/or FWS as required by the ESA.
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Acronyms and Abbreviations

BA  Biological Assessment
BRMP  Biological Resource 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
ETF  Effluent Treatment Facility
FMO  Foraging, Migration, and Overwintering
FWS  U. S. Fish and Wildlife Service
HRNM  Hanford Reach National Monument
MSA  Magnuson-Stevens Fisheries Conservation and Management Act
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
RL  U. S. Department of Energy, Richland Operations Office
RM  River Mile
SWPPP  Stormwater Pollution Prevention Plan
TEDF  Treated Effluent Disposal Facility
WDFW  Washington Department of Fish and Wildlife
WSAHGP  Washington State Aquatic habitat Guidelines Program
1.0 INTRODUCTION

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

- 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 FWS
  - May affect, but are not likely to adversely affect listed species or their critical habitat - RL will provide NMFS and FWS 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 (MSA) 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 MSA 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 MSA. RL actions, if carried out in accordance with this plan, are not likely to adversely impact EFH.

1.1 HANFORD SITE BACKGROUND

RL’s 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. RL’s current mission at the Hanford Site is to cleanup and stabilize facilities, wastes, and contaminated areas associated with Hanford’s former role in nuclear weapons production from 1943 to the late 1980s. 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 mission began during World War II as a site for production and processing of 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. Other contaminant reduction measures have included utilizing cooling ponds prior to discharge to the river, closed-loop cooling systems, and improved administrative controls and monitoring under the standards imposed through the Clean Water Act. Currently, the primary mission at Hanford is cleaning up contaminants that remain within or were released from these storage and disposal systems.

1.2 HANFORD SITE LAND USE

The Hanford Site comprises approximately 1,450 km² (560 mi²) within the lower Columbia Basin, and is subdivided into operational areas, each with specific functions. The major areas on the Site are (see Figure 1):

- The six 100 Areas along the south and west banks of the Columbia River. These are the locations of the nine former plutonium-production reactors that were shut down between the mid 1960’s and the mid 1980’s. Most of the waste sites associated with these reactors have been remediated, and most of the 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 the sites for 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 of the 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 but does contain some waste disposal sites. This area is further subdivided as follows:
  - 0.4 km² (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 km² (1.7 mi²) 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), mostly managed by the FWS. The FWS-managed portions of the HRNM include:
    - The Fitzner-Eberhardt Arid Lands Ecology Reserve, which is also a National Environmental Research Park. It occupies 310 km² (121 mi²) in the southwest quadrant of the Hanford Site,
    - The Wahluke, Saddle Mountain, and Ringold Units of the HRNM, which together comprise a 355 km² (139 mi²) area on the north and east bank of the Columbia River.
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.

RL is the landowner over the entire Hanford Site, although the FWS manages portions of the Site along the northern and eastern shores of the Columbia River and the Fitzner-Eberhardt Arid Lands Ecology Reserve. This plan does not cover actions taken by the FWS within the HRNM. Recreational or other non-RL uses of the Hanford Reach within the boundaries of the Hanford Site 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).
Figure 1. Principle Features of the Hanford Site
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 and Upper Columbia River Steelhead as endangered species under the ESA. This management plan was published in April of 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 agreed to request project-specific consultation under Section 7 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 FWS to address potential impacts associated with projects occurring in the nearshore areas. RL has also conducted several informal consultations for projects determined to cause no adverse effect on 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 (2008) determined that the proposed sampling efforts may affect, but were not likely to adversely affect listed spring-run Chinook or steelhead, or their critical habitat, and that the proposed conservation measures would be adequate to protect EFH for fall-run Chinook and coho salmon. This determination was reaffirmed and extended indefinitely in July 2013 (NMFS 2013a).

In the fall of 2010, RL prepared two separate biological assessments (BA) for the removal and remediation of River intake structures. The demolition/disposition of the 181-KE and 181-KW River Intake Structures was addressed by CH2M HILL Plateau Remediation Company for RL (CHPRC 2010a), and DOE (2010) addressed the demolition of 181-N and 181-NE intake structures, and the 1908-NE discharge structure. Both of these BAs evaluated potential impacts to upper Columbia River Spring Chinook salmon, upper Columbia River steelhead, and bull trout. The FWS concurred with the “may affect, not likely to adversely affect” determination for bull trout for the 181-KE /181-KW project on 18 January 2011 (FWS 2011a), and with the similar determination for the 100-N Area project on 14 July 2011 (FWS 2011b). NMFS provided comments on the BA for 100K 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 (NMFS 2011a) in which it determined that the proposed work at 100N would adversely affect listed species, but would not jeopardize the species or result in the destruction or adverse modification of designated critical habitat. 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 FWS concurred with the “may affect, not likely to adversely affect” determination regarding these activities on July 25, 2011 (FWS 2011c). Other environmental sampling activities have been performed for RL under consultations or Section 10 permits obtained by 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 was not likely to adversely affect listed spring-run Chinook and steelhead or their critical habitat; NMFS concurred (NMFS 2013b), and also concluded that the proposed action would not adversely affect EFH. This consultation was extended to include the installation of aquifer tubes near 100BC area in July 2013 (NMFS 2013c).

A draft of this management plan was submitted to FWS and NMFS in October, 2012. FWS concurred with the proposed determinations regarding bull trout, with a few stipulations (FWS 2012). NMFS provided comments, and determined that it required more information and had concerns with some of the proposed determinations. RL revised the document and incorporated 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, and 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 United States-Canada border to the Los Angeles basin (61 FR 56138).

Declines of 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 of the Columbia River 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 status per U.S. District Court decision in June 2007; status upgraded to threatened per U.S. District Court order in June 2009. NMFS issued results of a five-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 FWS 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 ESU (source: 70 FR 52630)
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 from the Yakima River, Washington, to the U.S.-Canada border, as well six artificial propagation programs: the Wenatchee River, Wells Hatchery (in the Methow and Okanogan Rivers), Winthrop 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 of the Columbia River (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 with the assistance of FWS 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 Summer-run Steelhead Critical Habitat (source: 70 FR 52630)
2.2 SPRING RUN CHINOOK SALMON

On March 9, 1998, NMFS determined that listing under the ESA was not warranted for the Mid-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 km² in Oregon and Washington. The Mid-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 activities are not expected to have any impacts on this ESU, and there will be no effect from Hanford 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 five-year review on Aug. 15, 2011 and concluded that this species should remain listed as endangered (76 FR 50447). The 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 NFH, 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 the Reach serves as a migration corridor for adults and juveniles, and juveniles may use the shallows of the 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 of the Columbia River 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 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).
Figure 4. Upper Columbia River Spring-run Chinook Salmon ESU. (Source: 70 FR 52630)
Figure 5. Upper Columbia River Spring-run Chinook Salmon Critical Habitat (70 FR 52630)
2.3 BULL TROUT

On June 10, 1998 the FWS 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 FWS listed all bull trout in the coterminous United States as threatened (64 FR 58910). The FWS completed a 5-year status review in 2008 that determined that no change in listing status was warranted (FWS 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 central Idaho mountains, upper Clark Fork and Flathead Rivers in Montana, and several streams in the Blue Mountains in Washington and Oregon.

The FWS 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 FWS 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 FWS 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 the 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 where a combination of water depth, lower velocities, comparatively warmer water, and availability of food provide suitable habitat for bull trout (69 FR 59996). Bull trout use of the Columbia River has been documented by radio-tagging studies conducted by the FWS (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 reach of the lower Columbia River as well (Wachtel 2000 as cited in 69 FR 59996). Radiotelemetry 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.
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

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 since 1962 into the Hanford Reach. 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 of the 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 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 (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 Reach, the Reach also serves as an important holding and rearing area for yearling steelhead produced further 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) were 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 make nests (redds) in the gravel and cobble substrate of the river bottom. In Idaho’s Clearwater and Salmon Rivers, the preferred gravel size for nesting was 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 are available within the Hanford Reach.

Any spawning within the 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 Reach.

The quantity and location of steelhead spawning in the Hanford Reach is unclear because aerial surveys of steelhead spawning are difficult, if not impossible, 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 (1100 to 2200 m³/s (39000 to 78000 ft³/s) – normal average flow is ~3400 m³/s (120,000 ft³/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 reddss 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 30 April 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 that had redds 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)
Aerial surveys of steelhead were performed in spring 1999 through 2002, and 2004 through 2010. A comprehensive study was conducted in spring 1999 to survey likely spawning areas near Locke Island, but no steelhead redds were found (Mueller and Geist 1999). The 100-N Area shoreline was investigated by aerial and boat surveys during spring 2005 to search for spawning areas (Poston 2010). Results of these surveys show only limited spawning near the Ringold Hatchery Creek (near river mile 355) in certain years. One verified steelhead redd was 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.

Steelhead eggs hatch in about 50 days when water temperatures are 10°C (50°F) (Wydoski and Whitney 1979). If significant steelhead spawning does occur in the Hanford Reach, a lack of sub-yearling juveniles found during the course of other studies may suggest that hatching success is low. Gray and Dauble (1976) reported that young-of-the-year steelhead were not collected by small-mesh beach seine in areas where, and at times of the year when juvenile steelhead should have been present. Similar studies in which young-of-the-year steelhead should have been captured resulted in little or no success (Dauble et al. 1989).

REARING

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 provide 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 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 and 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 on-going 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, they...
may not have emerged from the gravel at the time most of the fall Chinook salmon studies were conducted. Newly hatched steelhead fry are often found within near-shore 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

<table>
<thead>
<tr>
<th>Life Stage</th>
<th>Return Migration</th>
<th>Adult holdover in Reach</th>
<th>Spawning</th>
<th>Egg Stage</th>
<th>Intragravel development</th>
<th>Rearing</th>
<th>Outmigration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dates in Hanford Reach</td>
<td>Year round</td>
<td>1 September to 1 March</td>
<td>1 February to 1 June</td>
<td>1 February to 1 July</td>
<td>1 May to 15 July</td>
<td>Year round</td>
<td>1 April to 1 July</td>
</tr>
<tr>
<td>Food</td>
<td>None</td>
<td>Caddis larvae, midge larvae, zooplankton, adult insects, fish</td>
<td>Caddis larvae, midge larvae, zooplankton</td>
<td>Caddis larvae, midge larvae, zooplankton</td>
<td>Caddis larvae, midge larvae, zooplankton</td>
<td>Caddis larvae, midge larvae, zooplankton</td>
<td></td>
</tr>
<tr>
<td>Habitat</td>
<td>Pelagic - throughout water column</td>
<td>Pelagic - throughout water column</td>
<td>Gravels in mapped areas</td>
<td>Gravels in mapped areas</td>
<td>Deeper water (not main channel &amp; not nearshore)</td>
<td>Main Channel at night, nearshore feeding during day</td>
<td></td>
</tr>
</tbody>
</table>

### 3.2 UPPER COLUMBIA RIVER ESU SPRING CHINOOK SALMON

The life history of the 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 of the Columbia River (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 fresh water 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 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 Spring-Run ESU Chinook Salmon

<table>
<thead>
<tr>
<th>Life Stage</th>
<th>Return Migration</th>
<th>Spawning</th>
<th>Intragravel development</th>
<th>Rearing</th>
<th>Outmigration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dates in Hanford Reach</td>
<td>1 April to 15 June</td>
<td>Above Reach</td>
<td>Above Reach</td>
<td>Above Reach</td>
<td>1 April to 1 September</td>
</tr>
<tr>
<td>Food</td>
<td>None</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Caddis adults, midge adults</td>
</tr>
<tr>
<td>Habitat</td>
<td>Near shore</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Main Channel at night, nearshore feeding during day</td>
</tr>
</tbody>
</table>

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 Reach in the last 30 years. From 1980 to 1998, 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 were comprised of 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 indeed 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 13408). 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 Bjorhn 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 percent 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 percent 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 (Fraleys 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 (Fraleys 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). Year around use of the Hanford Reach by bull trout is most likely precluded by summer water temperatures that typically range above 15°C 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. Subsequently, 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 bull trout 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, 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).
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 suggests 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 three 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 inches) in length and weigh up to 14.5 kg (32 pounds). Bull trout reach sexual maturity at between four and seven years of age and are known to live as long as twelve 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 sub-populations interbreed when some return to non-natal streams. Migratory fish may also re-establish extirpated local sub-populations.

PRESENCE WITHIN THE HANFORD REACH

The Columbia River population segment includes 141 sub-populations, and the FWS 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 FWS 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 FWS also identified 3 sub-populations 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, and Pfeifer et al. 2001). A bull trout radio telemetry study conducted by the Public Utility District of Grand County 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 radio tagged bull trout to migrate 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 one 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) indicates 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 sub-population of bull trout year around, 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

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
- ground water remediation actions that may affect the ground water entering the river
- ground water monitoring near or within the river
- other monitoring and research activities that may affect biota, water or sediments, and
- pesticide applications near the river.

Each of these activities is described in greater detail below, and determinations regarding the potential effects of these actions on listed steelhead, spring 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 ordinary high water mark (OHWM), on the shoreline between the OHWM and the edge of the river (wetted perimeter), or if the action is taking place within the water. A summary of these effect determinations is provided in Table 3.
One way that RL will ensure this management plan is implemented is 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 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 (described below) and considering the objectives of this plan in land management decision-making.

Table 3. RL activities on the Hanford Site that could potentially affect listed salmonids or their critical habitat

<table>
<thead>
<tr>
<th>Activity Type</th>
<th>Effect Determination for Activities Occurring in the Following Areas</th>
<th>Upland to OHWM</th>
<th>OHWM to Wetted Perimeter</th>
<th>In Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste Site Remediation and demolition</td>
<td>No Effect</td>
<td>May Affect, Not Likely to Adversely Affect</td>
<td>Further Consultation Required</td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>No Effect</td>
<td></td>
<td>Further Consultation Required</td>
<td>Further Consultation Required</td>
</tr>
<tr>
<td>Water Withdrawals</td>
<td>N/A</td>
<td>N/A</td>
<td>May Affect, Not Likely to Adversely Affect</td>
<td></td>
</tr>
<tr>
<td>Permitted Waste Water Discharges</td>
<td>No Effect</td>
<td>No Effect</td>
<td>May Affect, Not Likely to Adversely Affect</td>
<td></td>
</tr>
<tr>
<td>Groundwater Monitoring</td>
<td>No Effect</td>
<td>May Affect, Not Likely to Adversely Affect</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Groundwater Treatment</td>
<td>No Effect</td>
<td>No Effect</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Environmental Research</td>
<td>No Effect</td>
<td>No Effect</td>
<td>May Affect, Not Likely to Adversely Affect</td>
<td></td>
</tr>
<tr>
<td>Pesticide Applications</td>
<td>No Effect</td>
<td>May Affect, Not Likely to Adversely Affect</td>
<td>Further Consultation Required</td>
<td></td>
</tr>
</tbody>
</table>
RL’s 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.

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.

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 FWS 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 FWS 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, etc., followed by close-out sampling and backfill. Originally, there were many waste sites on the Hanford Site that 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 square meters below the OHWM at a given site. However, some of the 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 6000 square meters, 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 FWS 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.

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.
Table 4. Waste Sites that Extend Beyond the OHWM of the Columbia River

<table>
<thead>
<tr>
<th>Site Number</th>
<th>Site Name</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>300-257</td>
<td>309 Process Sewer to River</td>
<td>300</td>
</tr>
<tr>
<td>300-292</td>
<td>315 Water Filter Plant Waste Pipeline Segments</td>
<td>300</td>
</tr>
<tr>
<td>300 RLWS</td>
<td>300 Area Radioactive Liquid Waste Sewer, 300 Area RLWS</td>
<td>300</td>
</tr>
<tr>
<td>300-15</td>
<td>300 Area Process Sewer System</td>
<td>300</td>
</tr>
<tr>
<td>300-214</td>
<td>300 Area Retention Process Sewer, 300 RPS</td>
<td>300</td>
</tr>
<tr>
<td>300-257</td>
<td>309 Process Sewer to River</td>
<td>300</td>
</tr>
<tr>
<td>300-292</td>
<td>315 Water Filter Plant Waste Pipeline Segments</td>
<td>300</td>
</tr>
<tr>
<td>300-295</td>
<td>384 Powerhouse Coal Ash Waste Pipeline Segments</td>
<td>300</td>
</tr>
<tr>
<td>600-334</td>
<td>CMX Building</td>
<td>600</td>
</tr>
<tr>
<td>100-B-15</td>
<td>100BC River Effluent Pipelines, 100BC River Lines</td>
<td>100-B</td>
</tr>
<tr>
<td>100-D-60</td>
<td>100D River Lines, 100D/DR River Effluent Pipelines</td>
<td>100-D</td>
</tr>
<tr>
<td>100-D-65</td>
<td>116-D-5 Outfall Spillway, 1904D Spillway, 100-D-60:1 Flume</td>
<td>100-D</td>
</tr>
<tr>
<td>100-D-66</td>
<td>116-DR-5 Outfall, 1904-DR Spillway, 100-D-60:1 Flume</td>
<td>100-D</td>
</tr>
<tr>
<td>100-D-67</td>
<td>D Island, D Island Contamination</td>
<td>100-D</td>
</tr>
<tr>
<td>100-D-8</td>
<td>105-DR Process Sewer Outfall Site, 1907-DR, Undocumented Liquid Waste Site</td>
<td>100-D</td>
</tr>
<tr>
<td>100-D-50</td>
<td>100-DR Water Treatment Facilities Underground Pipelines</td>
<td>100-D</td>
</tr>
<tr>
<td>100-F-39</td>
<td>100F River Effluent Pipelines, 100F River Lines</td>
<td>100-F</td>
</tr>
<tr>
<td>100-F-59</td>
<td>Riparian Area Contamination Originating from 128-F-2</td>
<td>100-F</td>
</tr>
<tr>
<td>100-H-34</td>
<td>100H River Effluent Pipelines, 100H River Lines</td>
<td>100-H</td>
</tr>
<tr>
<td>100-H-36</td>
<td>116-H-S Spillway, 1904-H Spillway, 100-H-34:1 Flume (Spillway)</td>
<td>100-H</td>
</tr>
<tr>
<td>100-H-54</td>
<td>GPERS 100-H Shoreline Survey Unplanned Release</td>
<td>100-H</td>
</tr>
<tr>
<td>100-K-111</td>
<td>Effluent Seepage Area from 116-K-2</td>
<td>100-K</td>
</tr>
<tr>
<td>100-K-113</td>
<td>100KW Columbia River Effluent Pipeline</td>
<td>100-K</td>
</tr>
<tr>
<td>100-K-114</td>
<td>100KE Columbia River Effluent Pipeline</td>
<td>100-K</td>
</tr>
<tr>
<td>100-K-80</td>
<td>100KW River Effluent Pipeline, 100KW River Line</td>
<td>100-K</td>
</tr>
<tr>
<td>100-K-96</td>
<td>100KE River Effluent Pipeline, 100KE River Line</td>
<td>100-K</td>
</tr>
<tr>
<td>100-N-104</td>
<td>Raw Water Overflow Spillway</td>
<td>100-N</td>
</tr>
<tr>
<td>100-N-77</td>
<td>River Line from 1908-N Outfall, 100N River Effluent Pipeline</td>
<td>100-N</td>
</tr>
<tr>
<td>100-N-79</td>
<td>1908 N Outfall Structure, 1908-N Spillway, 100-N-77:1 Flume</td>
<td>100-N</td>
</tr>
<tr>
<td>100-N-80</td>
<td>River Line from 1908-NE Outfall</td>
<td>100-N</td>
</tr>
<tr>
<td>100-N-84</td>
<td>100-N 100-N Miscellaneous Pipelines</td>
<td>100-N</td>
</tr>
<tr>
<td>100-N-102</td>
<td>100-N Potentially Contaminated French Drains</td>
<td>100-N</td>
</tr>
<tr>
<td>100-N-103</td>
<td>100-N Steam Condensate French Drains</td>
<td>100-N</td>
</tr>
<tr>
<td>100-N-61</td>
<td>100-N Water Treatment and Storage Facilities Underground Pipelines</td>
<td>100-N</td>
</tr>
<tr>
<td>100-N-63</td>
<td>100-N Reactor (1314-N, 116-N-1 and 116-N-3) TSD Underground Pipelines</td>
<td>100-N</td>
</tr>
<tr>
<td>100-N-64</td>
<td>100-N Reactor 105/109-N Cooling Water Effluent Underground Pipelines</td>
<td>100-N</td>
</tr>
<tr>
<td>100-N-84</td>
<td>100-N 100-N Miscellaneous Pipelines</td>
<td>100-N</td>
</tr>
<tr>
<td>100-N-87</td>
<td>116-N Ventilation Stack Piping and French Drain</td>
<td>100-N</td>
</tr>
<tr>
<td>100-N-95</td>
<td>Hanford Generating Plant (185-N) Septic Tank</td>
<td>100-N</td>
</tr>
<tr>
<td>120-N-3</td>
<td>163-N Neutralization Pit and French Drain</td>
<td>100-N</td>
</tr>
</tbody>
</table>

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, 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 utilize accepted guidelines, such as Washington State Aquatic Habitat Guidelines Program (WSAHGP 2002), when designing streambank protection measures.

Waste site remediation actions that occur completely above the OHWM are expected to have no effect on listed species, assuming that 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 FWS 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 FWS 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 Best Management Practices, 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 CONSTRUCTION

Various construction activities on the Hanford Site could occur in the near-shore 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 on-going 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 FWS 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 the 300 Area.

**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 3800 m³/day (1,000,000 gal/day). To support this level of water use, two pumps at one of the facilities are activated for 3-4 hours every 2-3 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, 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 criteria described in NMFS (2011b) for active screen systems. 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 FWS under Section 7 of the Endangered Species Act 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 FWS when needed to assure that 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 100N without harming juvenile salmon or steelhead (CHPRC 2010b). If any future minor withdraws are needed, similar best management practices will be employed, and NMFS and FWS 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/FWS.

4.4 PERMITTED WATER DISCHARGES

The Environmental Protection Agency (EPA) permits wastewater discharges to the Columbia River on the Hanford Site under the National Pollution Discharge Elimination System (NPDES). These discharges are monitored to ensure they continue to meet the water quality parameters listed in the permits. Currently there is one individual NPDES permit (WA-002591-7) issued for the Hanford Site that covers discharges from the 100-K Reactor Area. An annual evaluation of the outfall is conducted to ensure that no sources of contamination are present that could reach the river during a storm event.

The 100-K outfall is not located in known steelhead spawning habitat (Figure 8) and will not impact steelhead, salmon, or bull trout through chemical or physical characteristics of the discharge water. Continuing to meet the conditions of the permits will prevent future impacts to listed salmonids. Therefore, operation of existing permitted outfalls at Hanford will have minimal impacts to steelhead, Upper Columbia River Spring-Run ESU Chinook salmon, bull trout, or their critical habitats.

Currently, the Hanford Site has five wastewater discharge permits which allow releases of liquid wastes to the ground, including the 200 Area Effluent Treatment Facility (ETF) (ST – 4500), the 200 Area Treated Effluent Disposal Facility (TEDF) (ST – 4502), Miscellaneous Streams (ST-4511), and two Washington State Sand and Gravel General permits: the Concrete Batch Plant (WAG-50-5180), and the Pit 30 Quarry (WAG-50-5181). The ETF is located in the 200 East Area and discharges treated wastewater to the State Approved Land Disposal Site located north of the 200 West Area. The ETF treats wastewater to drinking water standards except tritium. The TEDF consists of two five-acre infiltration ponds used to dispose of treated effluent from buildings in the 200 Areas. All effluents treated at the TEDF do not have direct contact with industrial processes. The Miscellaneous Streams permit allows hydrotest discharges, maintenance discharges, construction discharges, cooling water discharges, condensate discharges, water tanks, HAMMER Pond, incidental releases, waste treatment plant, and industrial stormwater. Washington State Sand and Gravel General Permits cover discharges
of process water, storm water, and mine dewatering activities associated with Sand and Gravel operations and rock quarries.

Permitted groundwater discharges on the Hanford Site are expected to have no effect on listed salmonids or their critical habitats. Although expected to have minimal effect, the permitted discharges to the Columbia River may affect the river environment, and are thus 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 new or additional NPDES permits. If such a need were to arise, RL would consult with NMFS and FWS 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 contaminants through remedial actions such as pump-and-treat systems (DOE 2012).

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 11,583 wells have been assigned unique identification numbers as of July, 2013 with 4,123 wells still in use. Wells currently in use include 1813 groundwater wells, 1034 vadose wells, 124 piezometers within host wells, 51 piezometer hosts, 33 independent piezometers, 113 lysimeters, 495 aquifer tubes, 131 borings, 284 soil tubes, and 45 other or undefined types of wells. All construction, maintenance, and decommissioning of wells on the Hanford Site are in accordance with Washington State provisions of WAC 173-160 (DOE 2012).
### Table 5. Hanford Site Well Types (Taken from DOE 2012)

<table>
<thead>
<tr>
<th>Well Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquifer Tube</td>
<td>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.</td>
</tr>
<tr>
<td>Boring</td>
<td>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.</td>
</tr>
<tr>
<td>Groundwater Well</td>
<td>A well 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.</td>
</tr>
<tr>
<td>Hosted Piezometer</td>
<td>A groundwater monitoring well 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.</td>
</tr>
<tr>
<td>Independent Piezometer</td>
<td>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.</td>
</tr>
<tr>
<td>Lysimeter</td>
<td>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.</td>
</tr>
<tr>
<td>Piezometer Host</td>
<td>A well with one or more piezometers constructed inside it.</td>
</tr>
<tr>
<td>Soil Tube</td>
<td>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.</td>
</tr>
<tr>
<td>Vadose Well</td>
<td>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.</td>
</tr>
</tbody>
</table>
In 2011, 924 wells and 280 aquifer tubes were sampled, many were sampled more than once for a total of 4,173 sampling events (DOE 2012). Well monitoring follows a standard procedure. Before a sample is taken, wells are purged of a volume of water equal to 3 water columns. In accordance with Hanford Facility Dangerous Waste Permit, Revision 8C, Permit Number WA7 89000 8967, if contaminated (higher than permit criteria) purgewater 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 2011 RL completed 89 new wells for monitoring, remediation, and characterization and decommissioned 108 wells that were no longer needed. During 2011, RL also drilled, sampled and decommissioned 49 direct-push and characterization boreholes. 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 m² [6500 ft²]). 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).

Decommissioning of wells consists of bringing in equipment either to pull the well casing or perforate it and fill it with grout to the surface, and then restoring 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 (30ft) 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 OHWM but above the OLWM may affect but are not likely to adversely affect listed salmonids or their critical habitat. RL will notify NMFS and FWS prior to installation of any new ground water 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 cleanup 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, so 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. RL currently operates five pump-and-treat systems on the Hanford Site within 2 kilometers of the Columbia River and additional systems in the 200 West Area. There are three pump-and-treat systems (KR-4, KX, and KW) at 100-K Area with 30 extraction wells, 17 injection wells and 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 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.

RL has installed a permeable reactive barrier, known as the In-Situ REDOX Manipulation Project, in the 100-D Area for in-situ chemical treatment of hexavalent chromium. The barrier intersects the portion of the groundwater plume with highest concentration of hexavalent chromium. The treatment area is approximately 680 meters (2250 ft) long with 65 wells. Sodium dithionate (Na2O6S2), which is injected into the chromate plume, 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 will 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 percent oxygen saturation at the river. Air entrapment caused by water table fluctuations has the most impact on dissolved 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 biological assessment that determined that there would not be a significant impact to listed salmon or steelhead (DOE 1999b).

RL has constructed a permeable reactive barrier in the 100-N Area for strontium-90 using apatite sequestration technology. Strontium-90 is sequestered by injecting calcium-citrate phosphate solution into the aquifer. Biodegradation of the citrate results in apatite precipitation. Strontium-90 ions in groundwater substitute for calcium ions through cation exchange and are trapped in the mineral matrix during apatite crystallization. RL is planning to expand this barrier to a length of 762 meters (2500 ft). The potential impacts of the 100-N apatite barrier on salmonids were evaluated by Poston (2010), who identified increased cation concentrations and dissolution of metals as the primary potential impacts. It was determined that neither of these factors was likely to have a detectable effect on migrating juvenile salmon or steelhead.

RL is proposing to use in-situ bioremediation to address petroleum contamination in the 100-N Area. Naturally occurring bacteria in the soil will be used to remove contaminants from the vadose zone and aquifer. Bioventing will be used to enhance the population of bacteria. Bioventing is a process in which oxygen is added by forcing air through the vadose zone soils.

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 (<1m [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 liters [5 gal]) and small
masses of sediment (<2 kilograms [4.4 lbs]). 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 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 are not likely to adversely affect listed salmonids or their critical habitat. 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 for each product by the U.S. EPA. 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.

RL has not historically sprayed pesticides 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 near shore environment. Application of EPA-approved pesticides below the OHWM that follow label instructions may affect, but are not likely to adversely affect listed salmonids. RL understands that 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 FWS prior to application below the OHWM. Any deviations from these requirements will necessitate consultation with NMFS/FWS prior to application.
5.0 Magnuson-Stevens Fishery Conservation and Management Act

Federal agencies are directed, under 305(b)(2) of the MSA to consult NMFS regarding actions that are authorized, funded, or undertaken by that agency that may adversely affect EFH. EFH is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” The Hanford Reach of the Columbia River provides habitat for various life stages of Chinook and coho (Oncorhynchus kisutch) 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 near shore environment and are vulnerable to stranding.

RL will follow best management practices to minimize impacts to EFH for fall Chinook and other anadromous salmonids including:

- 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 REFERENCES


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Federal Register.

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Critical Habitat for 12 Evolutionarily Significant Units of West Coast Salmon and Steelhead in


Fish Passage Center Website. [http://www.fpc.org/bulltrout/bulltrout_home.html](http://www.fpc.org/bulltrout/bulltrout_home.html).


Magnuson-Stevens Fisheries Conservation and Management Act. 16 USC 1801-1884.


