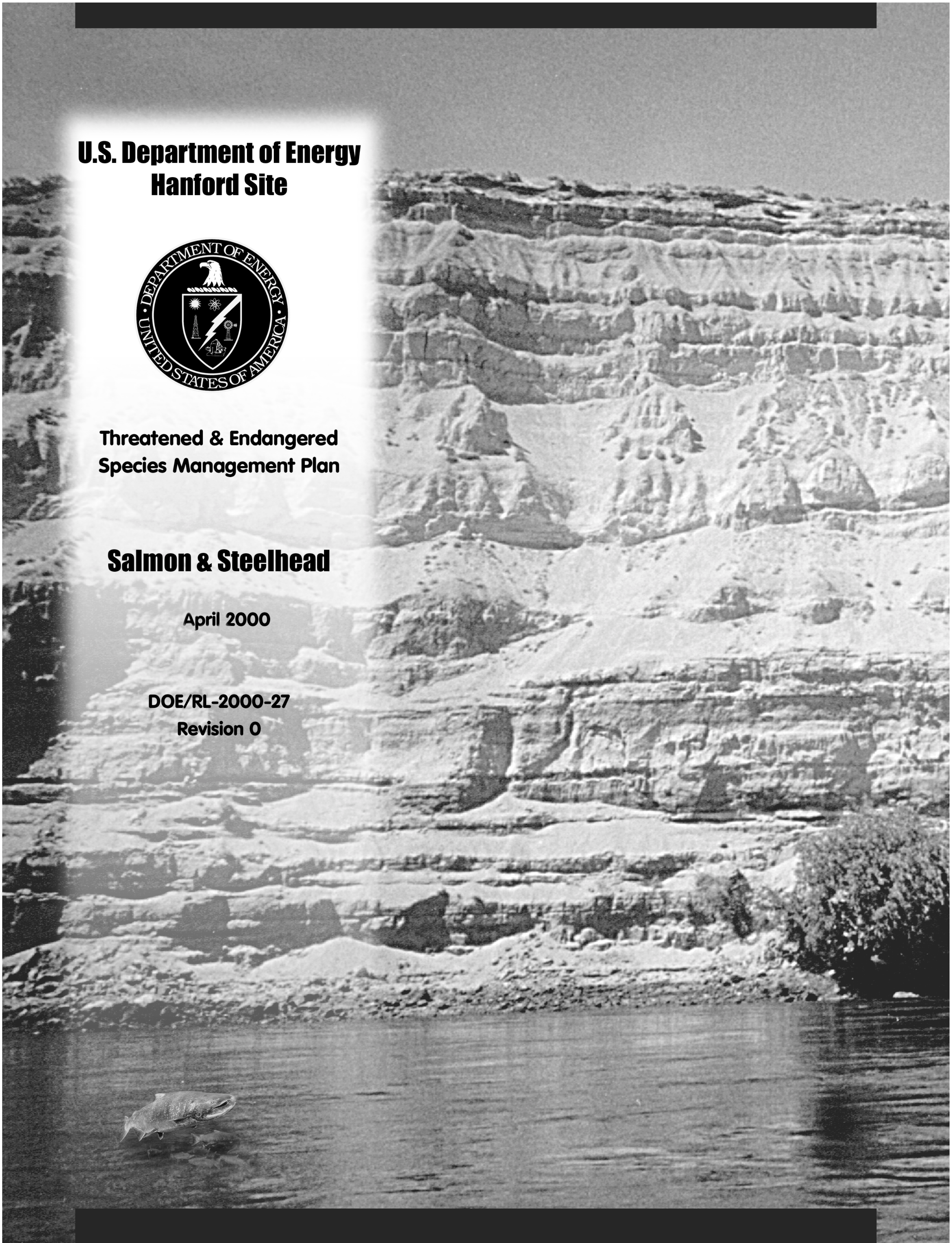


U.S. Department of Energy Hanford Site

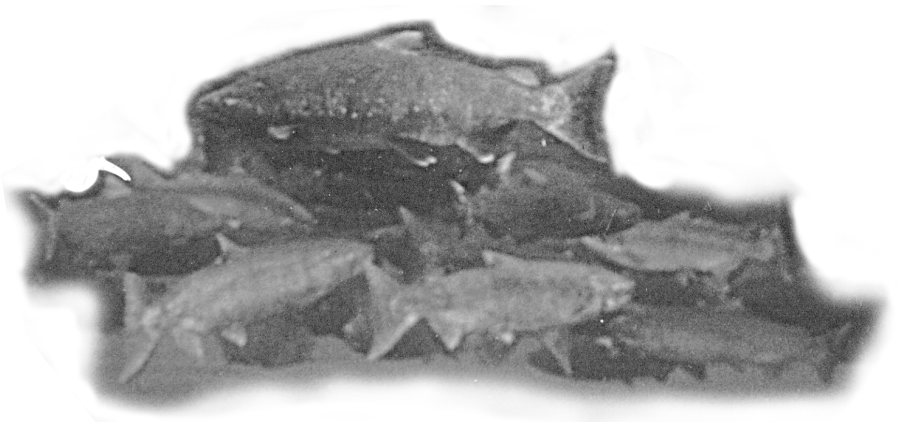
Threatened & Endangered Species Management Plan

Salmon & Steelhead

April 2000

DOE/RL-2000-27
Revision 0

DOE/RL-2000-27



U.S. Department of Energy, Hanford Site Threatened & Endangered Species Management Plan

April 2000

Summary

This *Salmon and Steelhead Management Plan* was prepared to define the U.S. Department of Energy-Richland Operations Office (DOE-RL) commitment to protecting and enhancing stocks of spring chinook salmon (*Oncorhynchus tschawytscha*) and steelhead (*Oncorhynchus mykiss*) within the Hanford Reach of the Columbia River. The Plan also constitutes a consultation document between DOE and the National Marine Fisheries Service (NMFS) as required under the Endangered Species Act (ESA). This Plan was prepared in response to the 1998 and 1999 listing of steelhead and spring chinook salmon within the Columbia River system in the lower Columbia Basin for protection under the ESA.

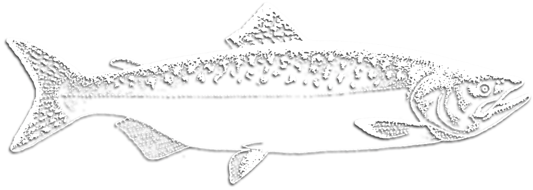
The Hanford Site comprises 1,450 km^2, subdivided into 13 operational areas with specific functions. Of these, the six 100 Areas and the 300 Area are closest to the Columbia River and have the most potential for affecting anadromous fish. DOE-RL is the landowner of the entire Hanford Site, although day-to-day management of portions of the Site has been turned over to other agencies.

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 the 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 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, but a few hatchery fish may spawn in the river. If so, they are not protected under the ESA. However, the Reach is used by inmigrating salmon as a passage corridor, and by outmigrating juvenile salmon as a 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.

Hanford activities that have the potential for impacting steelhead and salmon include water withdrawals, permitted wastewater discharges, groundwater monitoring near the shoreline, groundwater treatment activities conducted near the shoreline, waste site remediation near the shoreline, ecological and cultural research and monitoring programs conducted on the river or shoreline, and alterations of the shoreline for public access purposes.

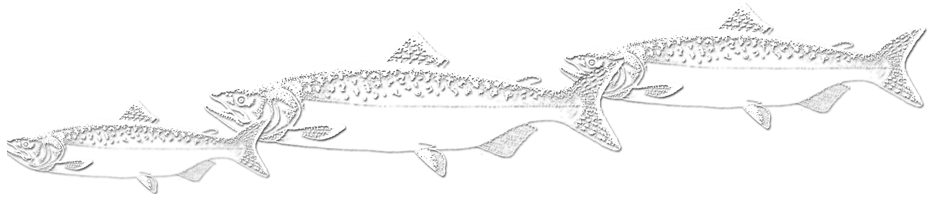
Potential effects include impingement and entrainment from water withdrawals, toxicity of wastewater discharges, shoreline and riverbed modifications that affect siltation or habitat, siltation from surface runoff, toxic modifications of groundwater plumes, harassment from boat traffic on DOE projects, 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 will affect the continued existence of the listed salmon or steelhead within the Hanford Reach, and will they not modify critical habitat.



To ensure protective management of these listed species, DOE-RL will ensure that the DOE-RL and its contractors conduct activities that preserve, protect, and perpetuate steelhead spawning and rearing habitat. These actions will also ensure protection of migrating spring chinook adults and juveniles. Protection measures include following project-specific Best Management Practices and designing and implementing projects to meet the following criteria:

- Projects will avoid adverse impacts to steelhead by reducing the magnitude of water withdrawal and ensuring that all water diversions meet the state of Washington screening criteria or appropriate administrative controls.
- All material discharged to the Columbia River will meet the National Pollutant Discharge Elimination System (NPDES) permit for that discharge. To ensure that no impacts occur, no material will be discharged directly into spawning areas even if it meets the NPDES permit.
- Removal of native riparian or emergent vegetation will be minimized, and projects in riparian areas will be located where vegetation is already disturbed. Damaged vegetation will be replaced with native species for erosion protection. Where possible, hand-tools will be used for in-water work. In all cases, the use of heavy equipment below the ordinary high-water line will be minimized.
- Where possible, construction projects will not simplify shoreline structure. Modifications will be limited to shoreline areas that have been previously disturbed, or will maintain as much as possible the natural shoreline configuration, and will incorporate mitigation measures into project design.
- Riverbank protection, where required for a given project, will be done using bioengineering rather than hard armor. Final construction will produce banks at a 3:1 slope and consider the rooting zone of plants used for bioengineering, consistent with Washington Department of Fish and Wildlife (WDFW) criteria. Structures and/or modifications beneficial to fish or wildlife habitat (e.g., soil bioengineering, biotechnical design, rock barbs, etc.) as approved by WDFW will be incorporated into projects where it is feasible to do so.
- Hydrology and soil conditions that support riparian vegetation will be maintained by all projects doing work in that zone. Construction projects will be managed to ensure that soil removed in wetland or floodplain areas will be stockpiled separately from subsurface soils, that compaction of hydric soils will be minimized, and that subsurface soils are replaced first followed by the upper layer last.
- Silt-loaded surface runoff from areas disturbed by DOE activities will be minimized by avoiding impacts to shoreline vegetation. Any removal of native riparian or emergent vegetation will be minimized, and projects will be located as much as possible in areas previously disturbed. Adherence to a stormwater management plan (in the *Pollution Prevention Best Management Practices Plan*) will reduce potential impacts from runoff to steelhead and salmon habitat.
- Projects will avoid adverse impacts to steelhead and spring chinook salmon by avoiding disruptive activities in the river or on the shoreline during the period when fish are present (April to November).
- Management of existing groundwater cleanup activities within the above criteria will minimize impacts to steelhead and salmon.
- Under no circumstances will activities that could result in capture or harm to steelhead or spring chinook salmon be conducted without consulting with NMFS. Activities will not be conducted that will modify critical habitats (the Columbia River and its riparian zone) in excess of the limitations identified above without specific consultation with NMFS.

If Hanford Site activities are carried out in accordance with this plan, such actions will not affect steelhead, spring chinook salmon, or modify their critical habitat. Activities that may be exceptions will involve formal or informal (whichever is appropriate) consultation with the NMFS as required by the ESA.



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Introduction

Spring chinook salmon (*Oncorhynchus tschawytscha*) and steelhead (*Oncorhynchus mykiss*) within the Columbia River system in the lower Columbia Basin are listed for protection under the Endangered Species Act (ESA). This Management Plan defines the U.S. Department of Energy-Richland Operations Office's (DOE-RL) commitment to protecting and enhancing stocks of these species within the Hanford Reach of the Columbia River. This Plan also constitutes a consultation document between DOE and the National Marine Fisheries Service (NMFS) as required under the Endangered Species Act (ESA). The objectives of this plan are to identify:

- the types of DOE-RL actions and facilities at the Hanford Site that could impact steelhead or spring chinook salmon or their critical habitat within the Hanford Reach
- those actions and facilities that will not affect these species or their critical habitat
- those actions and facilities that will require specific consultation under the ESA because of their potential to impact these species or their critical habitat
- management goals and criteria within DOE-RL's responsibility for protection of these species in the Hanford Reach.

SITE BACKGROUND

The DOE's Hanford Site occupies most of the Columbia River shoreline between Priest Rapids Dam and the McNary Dam pool in the lower Columbia Basin (Figure 1). This stretch of the river comprises the last undammed portion of the Columbia River within the United States above Bonneville Dam. DOE's primary mission at the Hanford Site is currently focused on cleanup and stabilization of facilities, waste forms, and contaminated areas that were associated with Hanford's role in nuclear weapons production during the second World War and subsequent Cold War period. Completion of this mission necessitates a variety of activities that will occur within the Columbia River and on its shoreline, or that will alter groundwater flows and/or composition entering the river.

The Hanford mission began during World War II as a site for the 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 using cooling ponds before 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 these storage and disposal systems and contaminants released from these systems.

LAND USE

The Hanford Site comprises approximately 1,450 km^2 within the lower Columbia Basin and is subdivided into operational areas, each with specific functions. The major areas on the Site are as follows (see Figure 1):

- The 100 Areas (BC, K, N, D, H, and F), located along the western (Benton County) bank of the Columbia River, are the locations of the nine plutonium-production reactors now being stabilized for ultimate decommissioning.

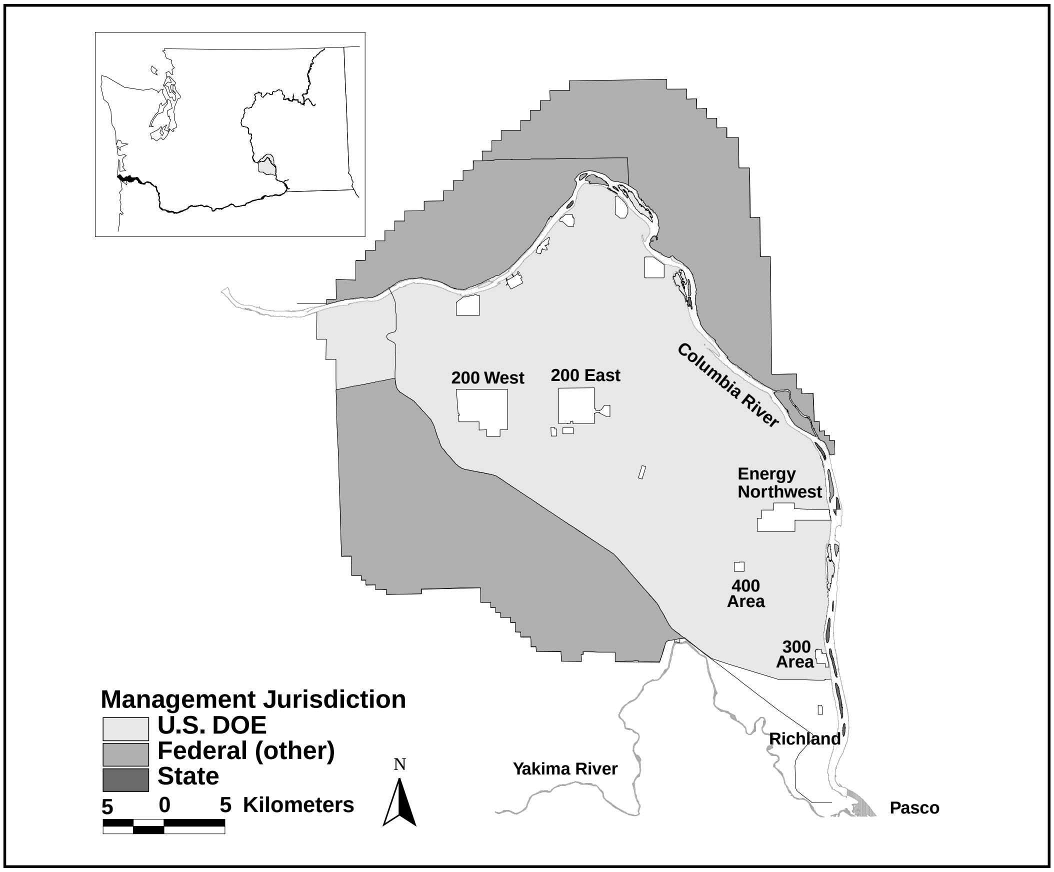


Figure 1. Location of the Hanford Site and its Primary Operations Areas.

- The 200 Areas (West and East), located on a plateau about 10 km from the Columbia River, were the sites for processing nuclear fuel and waste management and for disposal activities.
- The 300 Area, located just north of the city of Richland, was used for fuel assembly and test reactor experiments. It now contains experimental facilities and various laboratories.
- The 400 Area, about 8 km north of the 300 Area, is the location of the experimental breeder reactor known as the Fast Flux Test Facility (FFTF).
- The 600 Area is the core of the Hanford Site. It is not designated as an operations area, but contains some waste disposal sites. This area is further subdivided as follows:
  - The 310- km^2 Fitzner/Eberhardt Arid Lands Ecology (ALE) Reserve occupies the southwest quadrant of the site and is set aside for ecological studies. Management of the area has been transferred to the U.S. Fish and Wildlife Service.
  - 0.4 km^2 is leased by Washington State and contains a commercial low-level radioactive waste disposal facility.

- Energy Northwest leases 4.4 km^2 along the Columbia River north of the 300 Area for nuclear power production.
- The 355-km^2 area on the eastern (Franklin County) bank of the Columbia River is under revocable use permits to the U.S. Fish and Wildlife Service.

- The 1100 Area at the far southeastern portion of the Site was used as a support and maintenance area. It was turned over to Benton County in 1998.
- The 3000 Area is no longer owned by DOE, but contained the logistics support area. It lies along the southern boundary of the Hanford Site within the Richland city limits.

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

The DOE is the landowner of the entire Hanford Site, although day-to-day management of portions of the Site has been turned over to other agencies. The portions of the Site along the northern and eastern shores of the Columbia River are under management control of the U.S. Fish and Wildlife Service, as is ALE. Recreational or other non-DOE uses of the Hanford Reach within the boundaries of the Hanford Site are not under the control of DOE, so are outside the scope of this plan. The long-term vision for land use within the Hanford Site has recently been evaluated and set forth in the *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (DOE 1999).

FINDINGS RELATIVE TO IMPACTS ON STEELHEAD AND SPRING CHINOOK SALMON

If Hanford Site activities are carried out in accordance with this plan, such actions are not likely to adversely affect steelhead, spring chinook salmon, or their critical habitat. Activities that may be exceptions will involve formal or informal (whichever is appropriate) consultation with NMFS as required by the ESA.

Status of Steelhead Within the Region

Historically, steelhead probably occurred in most streams from the northern Baja Peninsula to Alaska. During the 20th century, at least 23 indigenous stocks are thought to have been exterminated. 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, including (62 FR 43937):

- 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 in the Columbia River that are within the boundaries of the Hanford Site are part of the Upper Columbia River Evolutionarily Significant Unit (ESU) as defined by NMFS (61 FR 56138, August 9, 1996-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 (see Figure 2) 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 (see Figure 2). 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

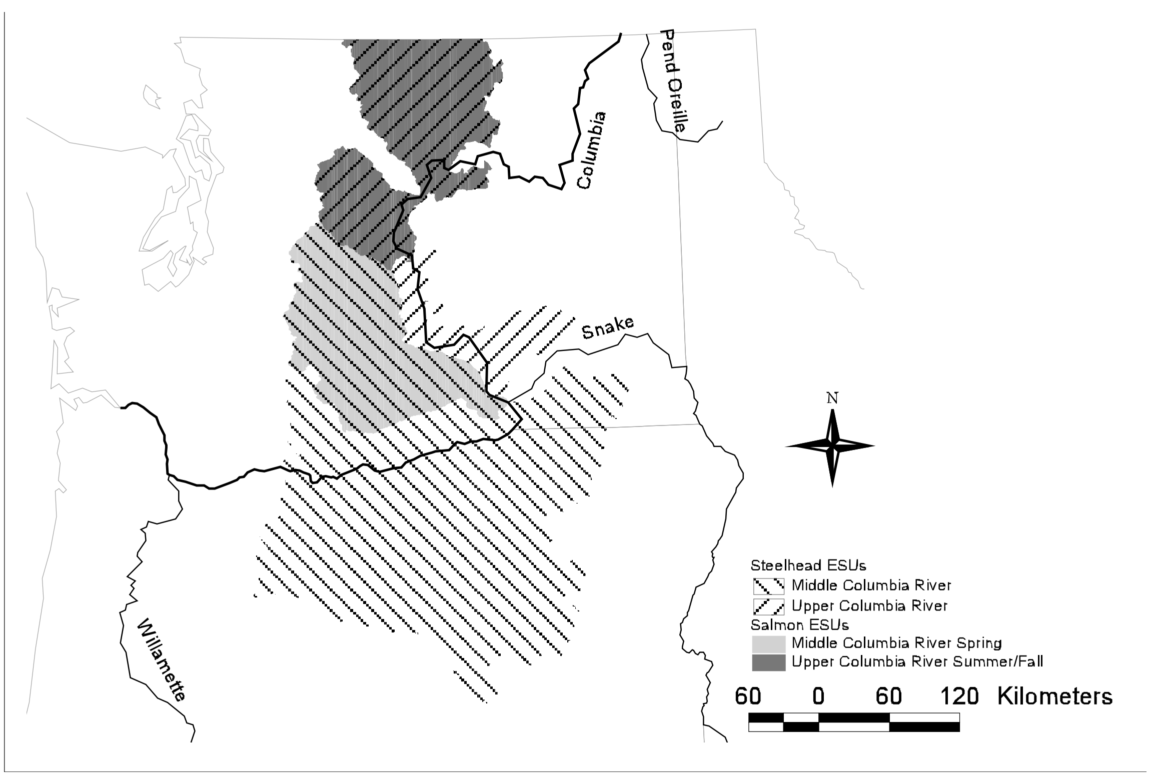
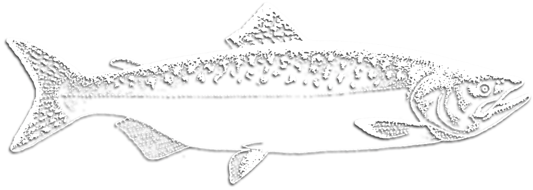


Figure 2. *Upper Columbia River Steelhead ESU.*



this ESU. Because of the lack of potential impact to this ESU, protection measures are not addressed in this plan.

Steelhead within the Upper Columbia River ESU were listed as endangered under the ESA by NMFS on August 11, 1997, with an effective date of October 17, 1997 (62 FR 43937, August 18, 1997). Steelhead covered in this listing include all naturally spawned populations of steelhead and their progeny in streams in the Columbia River Basin upstream from the Yakima River to the United States-Canada border, as well as the Wells Hatchery stock. Steelhead within the Middle Columbia River ESU and the Snake River ESU are listed as threatened.

Critical habitat for this ESU within the Hanford Site includes the entire Hanford Reach of the Columbia River (65 FR 7764, February 9, 2000). 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, DOE 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 7773, February 9, 2000).

The NMFS has identified a general listing of activities that could potentially result in harm to salmon and steelhead (62 FR 43937, August 18, 1997). The following apply, or could apply, to DOE-RL's activities on the Hanford Site:

- land-use changes resulting in mass wasting or surface erosion
- destruction or alteration of steelhead habitat
- discharges or dumping of toxic chemicals or other pollutants
- violation of discharge permits
- pesticide applications
- non-permitted collecting or handling of steelhead.

Status of Salmon Within the Region

On March 9, 1998, NMFS determined that listing under the ESA was not warranted for the Mid-Columbia River Spring-Run chinook ESU, 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 (Figure 2). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 69,000 km^2 in Oregon and Washington.

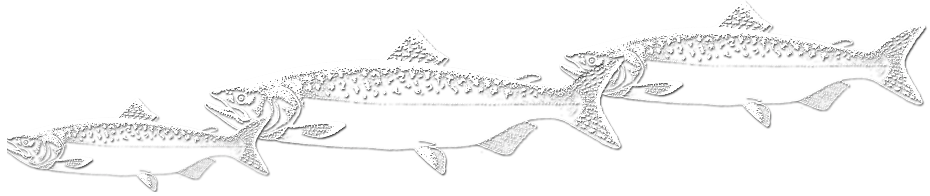
The Mid-Columbia ESU does not include fish within the Hanford Reach, but does include fish that migrate through the Yakima River to spawning grounds in that drainage basin. DOE activities are not expected to have any impacts on this ESU, and Hanford operations will not affect this ESU.

The Upper Columbia River Spring-Run ESU of chinook salmon was listed by NMFS as an endangered species on March 16, 1999. The ESU includes all naturally spawned populations of chinook salmon in all river reaches accessible to salmon in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River. Chinook salmon and their progeny from the following hatchery stocks are considered part of the listed ESU: Chiwawa River (spring run); Methow River (spring run); Twisp River (spring run); Chewuch River (spring run); White River (spring run); and Nason Creek (spring run).

These salmon do not spawn within the Hanford Reach, but the Reach does serve as a migration corridor for adults and juveniles, and juveniles may use the shallows of the reach as rearing areas.

Critical habitat for this ESU within the Hanford Site includes the entire Hanford Reach of the Columbia River (65 FR 7778, February 9, 2000). Functions of this habitat within the Hanford Reach include juvenile migration corridors and adult migration corridors.

To prevent impacts to this critical habitat, DOE 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 7773, February 9, 2000).



Biology of Upper Columbia River ESU Steelhead on the Hanford Site

Steelhead trout are anadromous, which means they live in the ocean but return to freshwater streams and rivers as adults to spawn. Most steelhead reside in the ocean for 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.

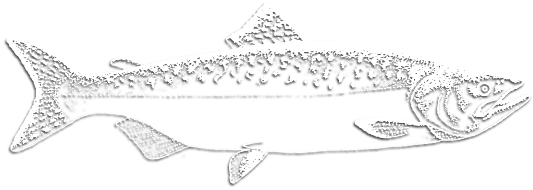
The relative mix of hatchery and wild steelhead that returns to the Hanford Reach is unknown. Ringold Hatchery (River km 570.5), operated by the Washington Department of Fish and Wildlife (WDFW), has been raising and releasing into the Hanford Reach an average of 163,000 steelhead smolts since 1962. The annual adult sport catch in the Ringold area from 1981 through 1991 averaged 4,707 fish (data provided by Art Brown, Fish Hatchery Specialist, WDFW, February 13, 1998). With the exception of an 8-year time period (1981 - 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 proposed eliminating the release of the Skamania stock and switching to the Wells Stock. This action is primarily in response to the listing of Wells stock steelhead under the ESA. It is not known how this action will affect the distribution of natural steelhead spawning that has undoubtedly resulted from the hatchery releases.

Unlike other anadromous salmonids, steelhead trout 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 juvenile steelhead trout. 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, midchannel 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.



SPAWNING 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 (PNNL, 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.

Information on the quantity and location of steelhead spawning is sketchy 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 was from the late 1960s and early 1970s during unusually low flow conditions (1,100 to 2,200 m^3/s- normal average flow is ~3400 m^3/s).

Key spawning areas reported from aerial surveys conducted in 1968 and 1970 included Vernita Bar, Coyote Rapids, Locke Island, 100-F islands, and Ringold (Tony Eldred, personal communication with D. R. Geist 9-28-89, see Figures 3 and 4). A total of 220 redds were counted in 1968 and 95 in 1970; total steelhead spawning was estimated by Eldred to be approximately 2,200 to 25,000 in 1968 and 950 to 7,800 in 1970. Fickeisen et al. (1980) indicated steelhead trout likely spawned at Vernita Bar, Coyote Rapids, Locke Island, and Ringold. An aerial survey conducted on 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)[a]. The area at Locke Island that had redds in the 1970s has since been silted over due to slumping from agricultural water seepage.

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, water depth 0.2 to 1.5 m, and water velocity 0.70 to 0.76 m/s (Orcutt et al. 1968); these habitat conditions are available within the Hanford Reach. The eggs hatch in about 50 days when water temperatures are 10°C (Wydoski and Whitney 1979).

If significant steelhead spawning occurs 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). If significant steelhead spawning occurs in the Hanford Reach, one would expect to find sub-yearling and pre-smolt juveniles (i.e., young-of-the-year).

(a) Dauble, D. D. 1998. Letter Report to Keith Wolf, Washington Department of Fish and Wildlife, October 22, 1998.

***Figure 3**. 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).*

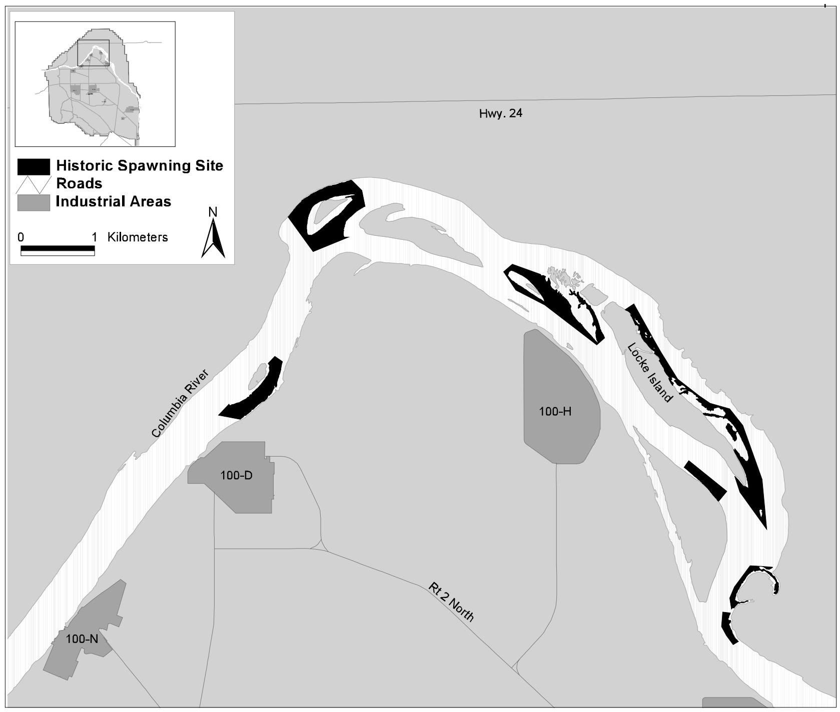


Figure 3. (contd)

Gray and Dauble (1976) reported that young-of-the-year steelhead were not collected by small-mesh beach seines in areas, and at the time of the year, when steelhead juveniles should have been present. Other studies have failed to collect young-of-the-year steelhead (Dauble et al. 1989; Wagner, personal communication, 1998). The lack 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 (viz Gray and Dauble 1976), many of the studies that reported not finding young-of-the-year steelhead were not specifically fishing for them but rather were targeting fall chinook salmon. Steelhead eggs hatch later than those of fall chinook salmon. Thus, they may not have emerged from the gravel at the time most 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.

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,

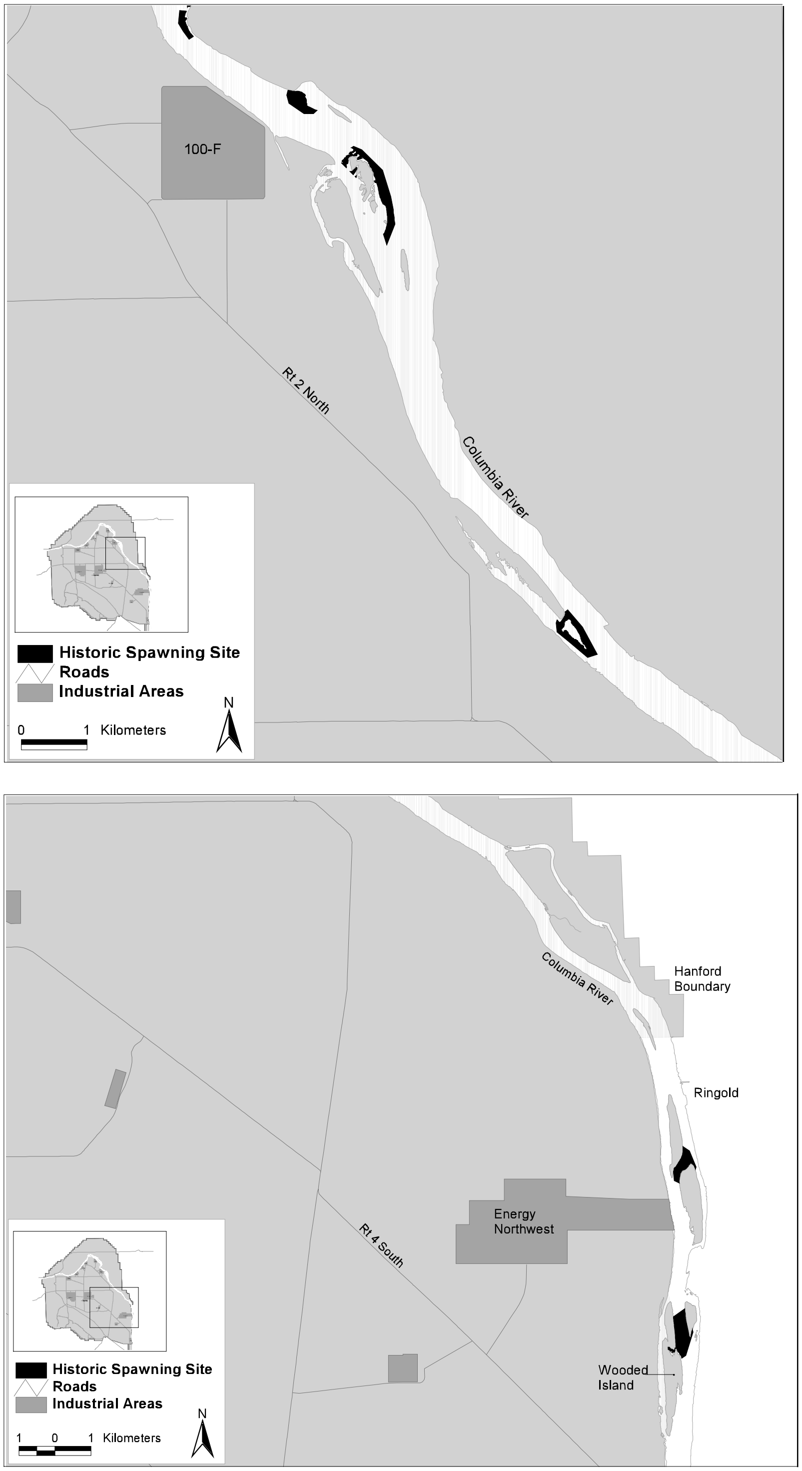


Figure 4*. Locations of Steelhead Redds Observed During Aerial Surveys in 1968 and 1970 in the Lower Portion of the Hanford Reach (T. Eldred, personal communication, September 28, 1989)*

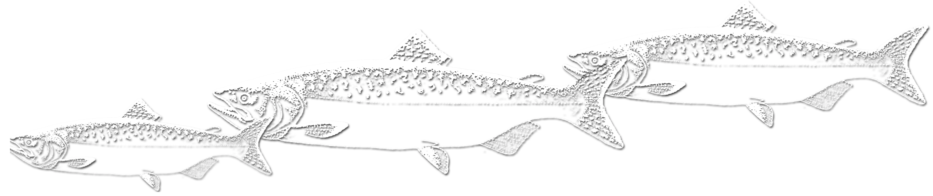
moderate temperature, and colonization sites for steelhead food sources (Shapovalov and Taft 1954; Bustard and Narver 1975; Peven 1990). As fry grow larger they feed primarily on benthic organisms, including midges, mayflies, stoneflies, and beetle larvae (Wydoski and Whitney 1979). Macroscopic analysis of steelhead smolts collected in the Hanford Reach in 1974 and 1975 showed that fish were consuming adult caddisflies (53%), larval caddisflies (35%), and midgefly larvae (15%) (Gray and Dauble 1977).

SUMMARY OF UPPER COLUMBIA RIVER STEELHEAD ESU USE OF HANFORD REACH

Table 1 summarizes steelhead usage of the Columbia River within the Hanford Reach. The table provides data on food, habitat, and dates in the Hanford Reach for each life stage, including return migration, adult holdover in Reach, spawning, egg stage, intragravel development, rearing, and outmigration.

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

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



Biology of Upper Columbia River ESU Spring Chinook on the Hanford Site

The life history of chinook salmon is complex and may vary depending on age at seaward migration; variation in length of freshwater, estuarine, and oceanic residence; ocean distribution and migratory patterns; and age and season of spawning migration (Healey 1991). Chinook salmon are similar to steelhead in that they, too, are anadromous and classified into runs based on when the adults return to their natal river to spawn.

All three runs (spring, summer, fall) of Columbia River chinook 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 are classified as a "stream-type" life history because the juveniles spend 1 or more years in freshwater before migrating to sea, and return to their natal river several months before 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 are similar to most other Pacific salmon in that they are semelparous (i.e., the fish dies after spawning once) (Healey 1991).

Juvenile spring-run chinook salmon are released from hatcheries into the Hanford Reach. In 1982, 196,000 age-1 spring chinook 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 17 years. From 1980 to 1998, the Ringold Fish Rearing Facility released an average of approximately 515,000 spring chinook salmon per year (range 0-1,200,000) into the Hanford Reach. These releases comprised various stocks, including Cowlitz (during the early 1980s), Klickitat, Carson, Yakima, and mixed stock returning to the Ringold hatchery.

Although spring-run chinook salmon are not known to spawn within the Hanford Reach, it is possible that a few hatchery fish spawn in the river. If

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

Life Stage					
Datum	**Return Migration**	**Spawning**	**Intragravel Development**	**Rearing**	**Outmigration**
Dates in Hanford Reach	1 April to 15 June	Above reach	Above reach	Above reach	1 April to 1 September
Food	None	-	-	-	Caddis adults, midge adults
Habitat	Nearshore	-	-	-	Main channel at night; nearshore feeding during day

they spawn in the Reach, these fish would be 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 (U.S. Dept. of Commerce 1998, 1999).

Juvenile Upper Columbia River Spring-Run ESU chinook salmon migrate downstream as smolts from April to September during their second year (Horner and Bjornn 1981; Becker 1985). Most migration takes place at night (Healey 1991; Mains and Smith 1955). Migrating smolts do not use nearshore habitat as do summer and fall chinook migrants, but instead, 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 runs. Period of travel from Priest Rapids Dam through the Hanford Reach to McNary Dam is estimated to take 3 days or less for active migrant spring chinook salmon smolts (Table 1; 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).

Hanford Activities Potentially Affecting Salmon or Steelhead

This section identifies various projects ongoing or planned for the Hanford Site that could affect steelhead, Upper Columbia River Spring-Run ESU chinook salmon, or their critical habitats within the Hanford Reach. Project descriptions are provided at a level of detail necessary to determine the severity of potential impacts on these species. Potential impacts to steelhead are divided into seven categories discussed in detail in the “Analysis of Effects” section of this plan.

Each project summary below lists the potential impact categories that need to be considered along with actions to mitigate each impact. Future projects with the potential to affect these species that are significantly different from the types of work defined here, and that fall outside the protection requirements as defined in the section titled “Salmon and Steelhead Protection on the Hanford Site,” will be required to consult with NMFS before taking any action that could affect these listed species or their critical habitats.

Water Withdrawals

The DOE/RL, has completed a review of Hanford Site Columbia River water pumping stations to determine compliance with fish protection requirements by the U.S. Department of the Army, Permit Number 95-1-00441. Currently, four water pumping stations at DOE facilities along the Columbia River potentially could impact juvenile fish. These are located at the 100-B/C, 100-D, and 100-KE Areas, and at the 300 Area. In addition, Pacific Northwest National Laboratory (PNNL) maintains a pumping facility on the Port of Benton dockyard south of the 300 Area. The WDFW conducted a surveillance of fish screen status at DOE facilities on December 21, 1994. That surveillance resulted in replacement of fish screens at two pumping stations, renovations to the other two pumping stations, and institution of administrative controls at 181-KE to mitigate possible impingement and entrainment impacts to juvenile anadromous fish.

181-B/C and 181-D Pumping Stations. These stations supply raw water from the Columbia River to the 200 East and West Areas. The old screens were mobile, in poor condition, and not in compliance with state regulations. The required dredging and installation of new passive fish screens at the two pump houses were completed by June 1996. The new screens have no moving parts, have openings no greater than 1.75 mm, and have an air backwash system to keep them free of debris. Water velocity through the screens is less than 0.1 m/sec. Also, new steel plates cover the pump house inlet channels to seal off openings between the pump house and the river.

181-KE Pumping Station. This station provides raw river water as makeup to the 100-K Area service water and potable water systems. The service water system provides makeup water to the 105-KE and 105-KW Spent Nuclear Fuel Storage Basins and is a source of water for fire protection and utility uses. The pumping station at one time also provided water to a fish rearing project directed by the Yakama Nation that is no longer in operation. The fish screens at the pumping station, originally designed and constructed in the 1950s and replaced in 1985, are made of stainless steel and are in good condition. However, the mesh openings (0.6 cm diameter) and the tangential flow velocity (0.2 m/sec) do not meet current state protection standards.

A study completed by PNNL (Neitzel et al. 1995) provided recommendations for controlling impingement and entrainment of juvenile anadromous fish at 181-KE. Based on this study, DOE-RL has proposed that administrative controls, without replacing the screens, could be effective in controlling negative impacts to juvenile salmonids. Administrative controls primarily focus on restricting pumping time during the critical period of March through June, which were found to be adequate to protect migrating juvenile fish. However, the study stated that continuation or re-startup of fish rearing activities would probably make administrative controls insufficient to control impacts to juvenile fish migrating along the river shoreline. Fish rearing has been suspended at 100-K and will not be reinitiated without consulting with NMFS or upgrading the screens to be consistent with WDFW design criteria.

300 Area Pumping Station. Fish screens at the 300 Area Pumping Station, which provides raw Columbia River water to the 331 Aquatic Laboratory fish tank, have been evaluated for compliance with WDFW requirements. To bring the system up to requirements, screens were reinforced to prevent bowing from debris accumulations, and a rubberized seal was installed between the framework and screen to eliminate potential impingement or entrainment gaps. This renovation was completed by August 1995.

Pacific Northwest National Laboratory. The PNNL withdraws water from the Columbia River for irrigation from March through November. In addition, the water is also used to refill the cooling ponds at the Richland Research Complex and for other general maintenance purposes. This water is pumped by two to three pumps (maximum of 0.06 m^3/s each) from a waterwell at the Port of Benton dock (the city of Richland also operates irrigation pumps at the same location). The pumps are screened with several types of screens, most of which are cleaned about once a year by pulling them out of the water. All screens meet the WDFW requirements for minimizing fish impact.

Some screens for the above pumps are cleaned underwater approximately every 5 years as part of routine maintenance. This process requires divers to clean the screens and does create some disturbance to the riverbed; however, hydraulic project approval is received from the WDFW before work is performed.

There are currently no new 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 would 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 under Section 7 of the ESA as part of the review process.

Permitted Discharges

The U.S. Environmental Protection Agency (EPA) permits wastewater discharges to the Columbia River on the Hanford Site under the National Pollutant Discharge Elimination System (NPDES). These discharges are monitored to ensure they continue to meet the parameters listed in the permits. Currently, one individual and one general NPDES permit have been issued for the Hanford Site. One permit (WA-002591-7) covers discharges from 100-K Reactor and the Treated Effluent Disposal Facility north of the 300-Area. Currently, there is one Multi-Sector Storm Water Permit (Sector 0) for storm water runoff through the 100-K Reactor outfall. An annual evaluation of the outfalls is conducted to ensure that no sources of contamination are present that could reach the river during a storm event.

None of the outfalls from these discharges are located in known steelhead spawning habitat and will not impact steelhead or salmon through chemical or physical characteristics of the discharge itself. Continuing to meet the conditions of the permits will prevent future impacts to steelhead or salmon. Therefore, operation of existing permitted outfalls at Hanford will not impact steelhead, Upper Columbia River Spring-Run ESU chinook salmon, or their critical habitats.

Groundwater Monitoring

Legacy wastes have contributed to plumes within the unsaturated (vadose) zone that either have or will reach the groundwater. Some groundwater plumes have reached the Columbia River (Hartman et al. 2000). The sources of these plumes are now-inactive waste or process ponds, ditches, cribs (similar to a sanitary septic tank), trenches, and various types of injection wells (also known as "reverse wells"), and French drains.

Currently, the primary discharge of liquid wastes to the ground is from the 200 West Area State Approved Land Disposal Structure (SALDS). SALDS receives liquids that are treated to comply with drinking water standards, except for tritium, at the 200 East Area Effluent Treatment Facility (ETF). The site for this facility was chosen so that the plume would not impact legacy waste sources, thereby creating or exacerbating a contaminant plume, and to provide sufficient residence time for the short-lived tritium isotope to decay before mixing with groundwater. Other potential discharges to groundwater are from the 200 Area ETF percolation pond and several sanitary tile fields.

Approximately 800 monitoring wells are located throughout the Hanford Site to monitor contaminants in groundwater. Of these, approximately 700 are sampled at one time or another during any given year (Hartman et al. 2000). Approximately 13 to 15 wells are near (<200 m) the river, but the monitoring activities described below are unlikely to impact the river.

Well monitoring follows a standard procedure. Before a sample is taken, the wells are purged of a volume of water equal to three water columns, which can range from 0.04 to 2 m^3, but is typically about 0.3 m^3. If the purgewater is from a contaminated portion of the aquifer, it is contained in tanker trucks and sent for appropriate disposal. If the purgewater is uncontaminated, it is discharged to the ground within 15 m of the wellhead. 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 3 to 4 days. This is only done a few times per year and rarely on the wells near the river. Strict procedures are followed to prevent erosion, and no water is discharged directly into the river.

Well installation and decommissioning are routine activities that will continue to occur at Hanford for several years. These activities may occur within the shoreline area (i.e., below the 100-year floodplain). The physical impact to the environment from these activities is generally minor because of the small area affected. Drilling a new well often involves clearing and/or leveling an area large enough for the drill rig and support equipment (typically 600 m^2). 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 (e.g., riparian or sagebrush steppe) is present, all efforts are made to keep the area of disturbance as small as possible. DOE-RL's Ecological Compliance Assessment Project (DOE 1995) evaluates each proposed project and identifies requirements that will minimize disturbance to high-quality or sensitive habitats or to protected species.

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. Decommissioning generally disturbs less area than does installation. For example, clearing and leveling the land surface is seldom required. Land disturbance from this activity is usually only from vehicle tracks.

Groundwater entering the Columbia River is monitored by temporarily installing small-diameter tubing in the shoreline to various depths. The installation typically involves driving a 2.5- to 3.75-cm-diameter steel tube, along with an inner plastic sample tube, into the gravels using 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-diameter sample tube in place. Sample tube locations are below the 100-year floodplain and generally just above the annual low-water shoreline. Installation takes place above the active waterline during the months of lowest river flow (August to November). Sampling is also conducted during low-flow periods when the sample tubes are accessible from shore.

The impacts from groundwater monitoring on shoreline habitat are considered to be minimal, consisting of temporary disturbance to vegetation 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. Sample collection does not require a vehicle and is conducted above the active waterline.

Groundwater Treatment

Contaminated groundwater from past activities at the Hanford Site is migrating toward the river (Hartman et al. 2000). Six pump-and-treat projects are currently operating at the Site (Table 3), and other groundwater treatment methods are being examined in pilot projects during the next few years.

Table 3. Pump and Treat Projects at Hanford in FY 1999 (Hartman et al. 2000).

Project Location	Contaminant	Number of Extraction Wells	Treatment System
100-K	Chromium	6	Ion-exchange
100-N	Strontium-90	3	Ion-exchange
100-D	Chromium	2	Ion-exchange
100-H	Chromium	5	Ion-exchange
200-West, 200-UP-1, OU	Uranium, Technetium-99	1	Ion-exchange, with effluent sent to state-approved land disposal
200-West, 200-ZP-1 OU	Carbon tetrachloride	6	Air stripping and activated carbon filtration

The intent of these treatments is to reduce the amount and extent of contaminants in groundwater before it reaches the river. Treatment options under examination include in-situ groundwater treatment and permeable barriers. Pump-and-treat systems have been implemented as pilot projects under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Pump-and-treat systems consist of a set of groundwater wells designed to clean up groundwater contamination. Wells are installed downgradient of a contamination plume to pump the water out of the ground. The groundwater is treated to remove contaminants and re-injected upgradient of the plume (except for 200-UP-1, see Table 3). 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.

A demonstration project involving in-situ groundwater treatment is currently underway that uses an oxidation-reduction reaction to treat a hexavalent chromium plume. This project, known as the In-Situ REDOX Manipulation Project, installed a series of wells approximately 150 m from the river in the 100-D area (to be expanded also into 100-H Area). Sodium dithionate ($Na_2O_6S_2$), 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 thus, is prevented from migrating to the river. This technology, if proven successful, will prevent the continual discharge of hexavalent chromium to the river where it may impact aquatic organisms, including salmon and steelhead eggs and fry. The treatment makes the groundwater anoxic, however, so it is being monitored as it reaches the river. It has not yet been determined if the groundwater will re-oxygenate before reaching the river.

Installation of a permeable barrier is a technology to intercept a contaminated groundwater plume and remove the contaminants. This technology has been proposed to treat groundwater at the 100-N Area of the Hanford Site that is contaminated with strontium-90. The proposed permeable barrier consists of a trench perpendicular to the flow of the groundwater (i.e., toward the river) to the depth of the contaminated portion of the aquifer. The trench would be approximately 1 m wide and would be filled with an ion exchange resin that would remove strontium-90 from the water as it moved through. When the resin becomes saturated, it would be replaced with new resin.

The proposed location of this treatment system is along the shoreline adjacent to 100-N. If chosen as the preferred treatment method for the 100-N strontium-90 plume, construction would occur above the shoreline, and no materials, including runoff, would be allowed to reach the river. This area is not a salmon or steelhead spawning area, and very little rearing habitat exists for young fish. Implementation of the protective measures spelled out for shoreline protection (see last section of this plan) will prevent any adverse impacts to steelhead or their habitats. Operation of this treatment system would benefit the Columbia River ecosystem by improving the quality of the groundwater entering the river.

Waste Site Remediation Projects

There are many waste sites on the Hanford Site that are near the river but above the shoreline area. These sites are associated with the reactor areas and the fuels production activities in the 300 Area. They include both liquid and solid waste.

Remediating these waste sites will be beneficial by removing the sources of contamination and preventing further movement of contaminants toward the river by groundwater. Remediation activities will generally not impact shoreline areas and habitats, with the potential exceptions described below. All excavation will include measures to prevent any run-off from remediation sites reaching shoreline habitats.

Currently, no remediation projects are planned within the shoreline areas of the Hanford Site. However, as cleanup progresses, contaminated soils could be identified within these areas and projects designed to remove the contamination. If contamination areas are small, and the remediation of these areas can be designed to meet all the protective measures for shoreline protection, then no impacts will occur to steelhead, salmon, or their critical habitats. If these protective measures cannot be met, and potential exists for harming salmon, steelhead, or their habitats, consultation with the NMFS will be initiated under Section 7 of the ESA.

The outfall structures consist of concrete weir boxes that stand at the top of the river bank. They received cooling water from the reactors, then discharged it to the river through buried pipes that extended roughly to the middle of the river channel. The distance from the outfalls to the ordinary high-water mark range from approximately 15 to 66 m. Decommissioning projects in the 1980s removed the above-grade portions of the outfalls and backfilled

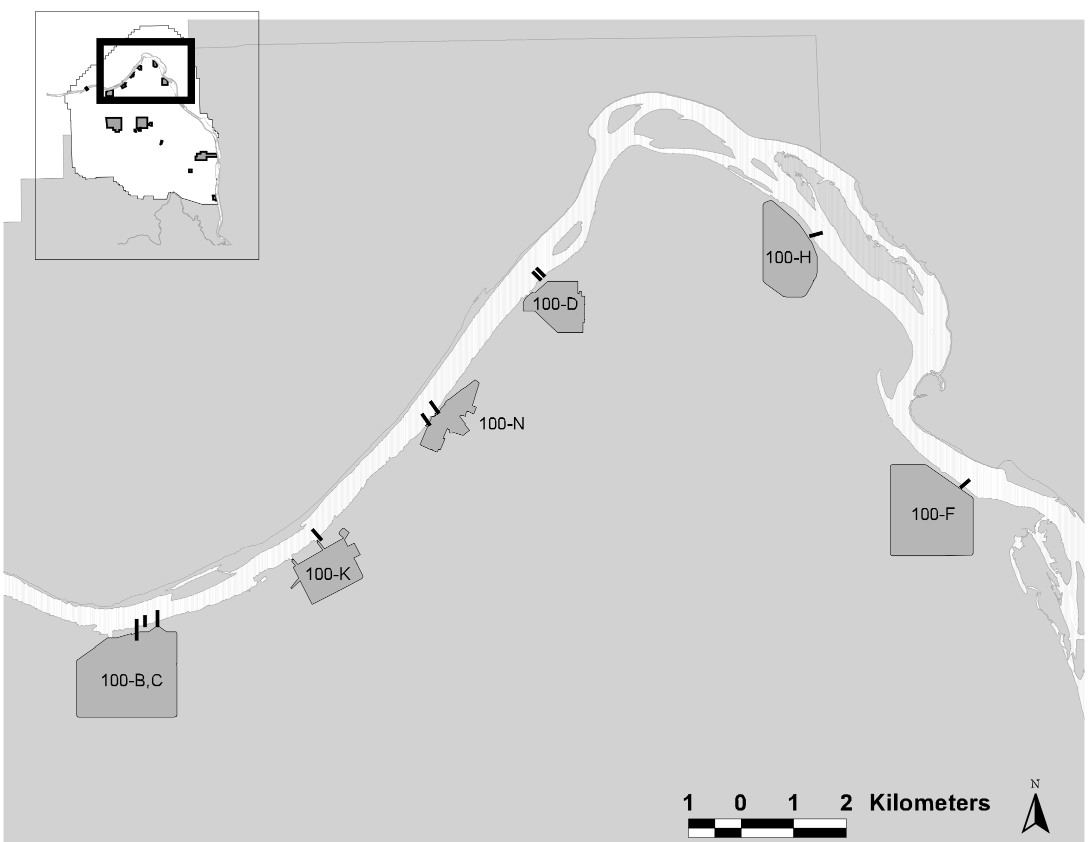


Figure 5. Locations of Outfall Structures and Discharge Piping from Hanford Reactors into the Columbia River.

the below-grade portions and covered them with soil. The ongoing Remedial Action projects at the reactor areas plan to remove the remaining outfall structures and cap the discharge lines that extend into the river. The excavations will proceed toward the river bank but will not extend below the ordinary high-water mark. Protective measures such as silt fence, hay bales, and/or other physical barriers will be installed between the excavation and the ordinary high-water mark to prevent any materials or runoff from reaching shoreline habitats.

These structures present no current threat to steelhead and salmon or their habitat because the pipes and remaining outfall structures have been plugged. If remediation activities extend into and beyond the ordinary high-water mark, and the protective measures identified in this plan could not be met, then consultation with NMFS would be required to establish appropriate mitigation actions.

Cultural Resource Research and Monitoring Activities

Monthly and sometimes weekly trips are made via boat and shoreline hikes to monitor the erosion of Locke Island at the north end of the Hanford Site and to evaluate projects under consideration along the shoreline. Some soil samples (<1 L) may be taken at certain locations. Visits to Locke Island are generally weekly by boat from May to August and monthly from September to April. Additional monitoring of the shoreline environment is conducted as needed to support other Hanford projects. Monitoring consists of visual inspections, although small-scale hand-excavations are rarely required. Such excavations disturb less than 1 m^3.

Ecological Research and Environmental Monitoring Activities

These activities consist of various types of biotic and abiotic sampling along with ecological evaluations and data gathering. Sampling is often conducted to look for contaminants in river sediments or in the porewater below the surface of the riverbed. 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. The sampling activities do not impact habitat integrity because only very small sample quantities (<1 L) are collected. Selected fishes are routinely collected, usually by electrofishing, throughout the Hanford Reach for various research purposes and for contaminant uptake monitoring. Ecological evaluations are non-disturbing activities that generally consist of wildlife and habitat observations in upland, riparian, and riverine environments. Topographic and bathymetric measurements could also be conducted.

Mitigation strategies for sample collection will include avoiding critical times of the year (e.g., spawning and juvenile rearing) and critical habitats. Mitigation strategies for ecological evaluations will include avoiding disturbing steelhead in spawning areas. In addition, the general strategies developed to prevent capture, harassment, or impacts from riverbed modifications will prevent any adverse effect to steelhead, Upper Columbia River Spring-Run ESU chinook salmon, or their critical habitats from sampling and ecological evaluation activities.

Public Access to Hanford Reach

A number of projects affecting public access to the Hanford Reach are being considered as DOE implements cleanup and land use changes on the Hanford Site (DOE 1999). These projects could take place within the next 10 years and could include:

- developing near-shore trail along the Reach and establishing interpretive centers in the vicinity of key landmarks (e.g., White Bluffs and Ringold ferry landings and the important reactor areas)
- upgrading existing boat launches at the White Bluffs and Ringold ferry landings
- allowing (via an easement) WDFW to construct a boat ramp and parking area at Vernita Bridge to replace existing uncontrolled boat launches in the area.

Except for the boat launches, no wetlands will be impacted, no dredge-and-fill permits will be required, and no shoreline modifications are anticipated. Best management practices will be followed in all project construction. None of the projects will involve point-source discharges.

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 requirements defined for each product. Any planned applications within the riparian area of the Columbia River will be performed consistent with the application requirements set by EPA and performed by licensed applicators. They will not result in any runoff or drift to the Columbia River environment. Any deviations from these requirements will necessitate consultation with NMFS before application.

Analysis of Effects

Activities on the Hanford Site that potentially could affect Upper Columbia River Spring-Run ESU chinook salmon, steelhead, or their critical habitats can be divided into seven categories: water withdrawal, discharge of material to the Columbia River, shoreline and riverbed modifications, surface runoff, modification of existing groundwater plumes, harassment, and capture. Relationships between projects and categories of effects are shown in Figure 6. Potential effects were analyzed by comparing the components of each project to thresholds of impacts developed for each category. A summary of the findings and mitigation requirements or other qualifications supporting the findings is provided at the end of this section.

Water Withdrawal

The construction and operation of water intake structures might be considered an adverse risk to steelhead or outmigrating Upper Columbia River Spring-Run ESU chinook salmon if any of the following conditions are true:

- The minimum Washington State criteria for fish screens (RCW 77.16.220; RCW 75.20.040; RCW 75.20.061; Table 3) are not met.
- The structure is large enough to disrupt fish migration longer than 1 day.
- The structure is located adjacent to known or potential steelhead spawning or high-use rearing areas for juvenile steelhead or Upper Columbia River Spring-Run ESU chinook salmon.

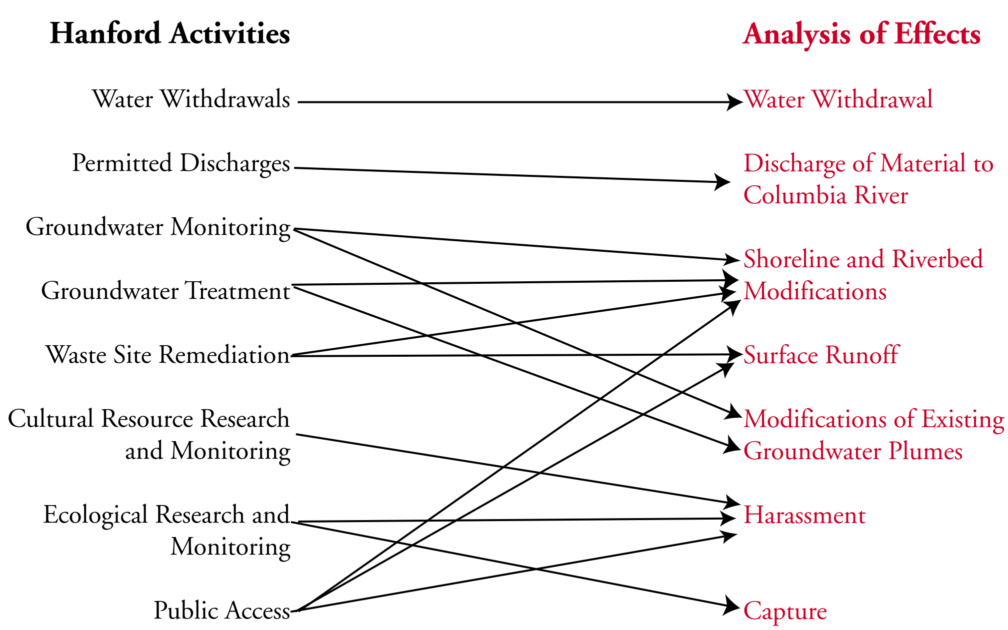
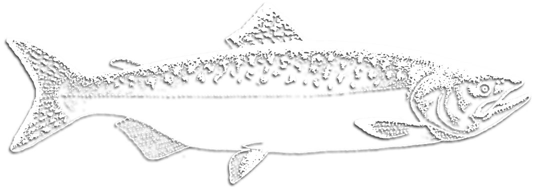


Figure 6. *Relationships between Hanford Projects and Categories of Effects on Upper Columbia River Spring-Run ESU Chinook Salmon or Steelhead.*



- The construction of the water intake structure results in a loss of critical habitat for steelhead or Upper Columbia River Spring-Run ESU chinook salmon.

All existing water intake structures on the Hanford Site meet the state of Washington screens criteria (Table 4) or are otherwise managed to meet WDFW goals for such withdrawals and are inspected annually. Periodically, the screens are removed for cleaning or are cleaned in place using divers. Whenever divers are used to clean the screens, a Hydraulic Project Approval is acquired from WDFW prior to any work; provisions in the permit ensure steelhead and salmon are not adversely impacted. Because all water intakes are permitted withdrawals, existing facilities are not likely to adversely affect steelhead or salmon. Although no new withdrawals are planned, any new structures will require Section 7 consultation with the NMFS if they exceed the above criteria.

Discharge of Material to Columbia River

Discharge to the Columbia River might be considered an adverse risk to salmon or steelhead if any of the following conditions are true:

- Point source discharges exceed site-wide or project specific NPDES permit conditions.
- The quantity of material excavated for the discharge structure below the ordinary high water mark exceeds 19 m^3.
- The discharge, including excavated area (see shoreline and riverbed modifications below), will cause the loss of more than 400 m^2 of a special aquatic site[a], including wetlands and critical steelhead habitat.

Wastewater discharges on the Hanford Site are permitted by EPA under NPDES as described in the federal Clean Water Act. The two Hanford discharges

Table 4. State of Washington Criteria for Water Intake Screens.

Component	Criteria
Screen orientation	The screen shall be located within flowing portion of the river parallel to the stream flow, continuous with adjacent bank line. Canals should be avoided.
Maximum approach velocity (component of the water velocity perpendicular to the face of the screen).	Maximum approach velocity shall not exceed 0.12 m/s with velocity evenly distributed across the face of the screen.
Maximum sweeping velocity (component of water velocity vector parallel to and immediately upstream of the scrren surface).	Maximum sweeping velocity shall equal or exceed the maximum allowable approach velocity.
Screen mesh size	Maximum screen mesh size for woven wire mesh is 2.2 mm (6-14 mesh); profile bar is 1.75 mm; and perforated plate is 2.4 mm.

(a) "Special aquatic sites include wetlands, mudflats, vegetated shallows, coral reefs, riffle pool complexes, and sanctuaries and refuges as defined at 40 CFR 230.40 through 230.45 (EPA Guidelines for Specification of Disposal Sites for Dredged or Fill Material)." (quoted from p. 11 of U.S. Army Corps of Engineers, Special Public Notice, Final Regions Conditions, 401 Water Quality Certification Conditions, Coastal Zone Management Consistency Responses, for Nationwide Permits for the Seattle District Corps of Engineers for the State of Washington. Effective date: 22 February 1977.

covered by NPDES permits are described in the previous section. A *Hanford Site Storm Water Pollution Prevention Plan* is in place that covers non-point source pollution control. The storm water outfall at the 100-K Area is evaluated annually to ensure that no sources(s) of contamination are present and that parameters of the Multi-Sector Storm Water NPDES permit are being met. Discharges that exceed NPDES permit-allowed limits are reported in monthly Discharge Monitoring Reports, in the annual Hanford Site Environmental Report, and in the Hanford Site Notification Report system. Because the outfalls are permitted and operated in compliance with the permit, they will not impact steelhead, Upper Columbia River Spring-Run ESU chinook salmon, or their critical habitats.

Shoreline and Riverbed Modifications

Shoreline[(a)] and riverbed modifications might be considered an adverse risk to Upper Columbia River Spring-Run ESU chinook salmon or steelhead if any of the following conditions are true:

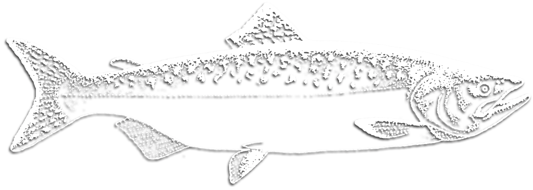
- The volume of excavated material below the ordinary high-water mark will exceed 19 m^3 or occurs within a known steelhead spawning area.
- The project will use fill material that is not clean, pre-washed, or free of fines.
- The project will use any upright structures within the floodplain (e.g., retaining walls, concrete or timber bulkheads).
- The area modified by the project, including any excavated area, will cause the loss of more than 400 m^2 of a special aquatic site, including native riparian and/or emergent vegetation, wetlands, or critical steelhead or Upper Columbia River Spring-Run ESU chinook salmon habitat.
- Shoreline or riverbed modifications will exceed 75 m parallel to the flow of the river.
- The project will require bank protection exceeding 0.4 m^3 per running foot placed along the bank below the line of ordinary high water.
- The project will place fill material in wetlands, or in such a way that prohibits water flow into or out of a wet area.
- The project will place fill material below the ordinary high water line that is easily eroded by medium to high flows (e.g., gravel for bank protection).
- The project will construct boat ramps wider than 3.6 m or using more than 15 m^3 of material, or will locate the boat ramp within a steelhead spawning area.

New projects on the Hanford Site that may disturb the shoreline include:

- construction of a recreational trail along the entire length of the Hanford Reach, including interpretive centers at various points along the route
- improvements in existing boat launches at White Bluffs and Ringold
- a new boat landing and interpretive center at Wahluke
- a new boat launch at Vernita.

The impact of specific projects will be considered when the activity is scheduled and permitted through the normal permitting process. Section 7 consultation with the appropriate federal agency will be required if a project will exceed any of the above criteria for shoreline and riverbed modifications. Otherwise, these projects are not likely to adversely affect steelhead, Upper Columbia River Spring-Run ESU chinook salmon, or their critical habitat.

(a) The shoreline is defined to include that portion of the floodplain that would be covered with water during a 100-year flood event. The lateral extent of the shoreline was delineated using the Hanford Reach unsteady flow model (Walters et al. 1994) to generate water surface elevations at the 100-year flood discharge and extrapolating these elevations onto a topographic map of the river floodplain (DOE 1996).



Various routine activities on the Hanford Site may slightly disturb the shoreline and/or riverbed but will not exceed the above criteria. These may include, but not be limited to, routine well installation and decommissioning, routine cleaning of water intake screens, and environmental sampling and ecological evaluations (including installation and sampling of shoreline sample tubes/piezometers). No impacts to Upper Columbia River Spring-Run ESU chinook salmon or steelhead from these activities would be expected. For example, well drilling may involve clearing and/or leveling approximately 600 m^2, but work is done above the high water mark, and there are no surface discharges. Well decommissioning involves less severe disturbance than installation, because clearing and leveling the sites is not required. Environmental sampling and ecological evaluations are conducted on exposed shorelines above water level and involve collecting very small quantities of sediment and/or biota. If sampling tubes/piezometers are installed, the impacts to riparian or aquatic vegetation and shoreline habitats are minor and temporary. No impacts to Upper Columbia River Spring-Run ESU chinook salmon and steelhead will result.

Mitigation actions that will be applied to these activities will include avoidance of sensitive habitats, avoidance of critical times of the year (i.e., spawning and rearing), prevention of all runoff and sedimentation, and minimization of area affected. These strategies will prevent any adverse effect from routine activities conducted on the Hanford Site within shoreline and riverbed environments.

Any shoreline or riverbed disturbance that exceeds the above criteria will require Section 7 consultation with the appropriate federal agency. Although not specifically planned at this time, activities that may require consultation include installation of groundwater permeable barriers, contaminant remediation of the shoreline that exceeds the above design criteria, and removal of existing outfall structures and discharge pipes.

Surface Runoff

Surface runoff might be considered an adverse risk to Upper Columbia River Spring-Run ESU chinook salmon, steelhead, or their critical habitat if any of the following conditions are true:

- The runoff material results in the exceedance of state water quality standards.
- The runoff material results in siltation of a potential or known steelhead spawning area.

Various routine activities on the Hanford Site could result in surface runoff but are not expected to exceed the above criteria. These may include, but not be limited to, routine groundwater monitoring and aquifer testing. The impacts to Upper Columbia River Spring-Run ESU chinook salmon or steelhead from these activities are insignificant because groundwater purged from the wells is not allowed to flow overland into the river. All new construction activities or ongoing activities will be conducted using Best Management Practices and a Stormwater Pollution Prevention Plan, which will ensure state water quality standards are not exceeded and runoff does not occur within a known or potential steelhead spawning area.

Modification of Existing Groundwater Plumes

Modification of groundwater plumes might be considered an adverse risk to Upper Columbia River Spring-Run ESU chinook salmon or steelhead if any of the following conditions are true:

- The plume results in the exceedance of state ambient water quality standards at the point of discharge to the river.
- The modification of the plume changes the magnitude or spatial extent of water flow within the sediments of the river-bed. This would be especially critical in known or potential steelhead spawning areas.

Activities on the Hanford Site that could modify groundwater plumes include groundwater cleanup through pump-and-treat or in-situ treatment (e.g., REDOX Project, permeable barrier). Each of these treatments should improve the quality of groundwater that enters the river by removing contaminants such as chromium and strontium. Thus, the treatments are expected to provide a net benefit to aquatic resources, including steelhead and salmon. In all cases, the projects will be conducted and monitored to ensure the above criteria are met. In the event that an activity has the potential to exceed state water quality standards or modify the magnitude or spatial extent of the water flow within the sediments, Section 7 consultation will be initiated with the NMFS.

Harassment

Activities that may be constituted as harassment might include, but not be limited to:

- mechanized pounding that exceeds sound pressure levels of 180 dB for longer than 1 hour at the redd or in rearing areas (Hastings 1995)
- electrofishing where steelhead or Upper Columbia River ESU spring chinook salmon may be taken
- prolonged boat activity (greater than 60 minutes) in known spawning areas at the time of spawning
- activities that would chase fish from a known spawning area for greater than 12 hour.

Activities on the Hanford Site that could disturb steelhead or salmon include electrofishing, deployment of in-water sampling equipment, and new installation of monitoring equipment such as groundwater sampling wells or piezometers near the shoreline. Other routine monitoring activities are not considered to have the potential to significantly disturb either salmon or steelhead. Hanford activities will not be conducted in known spawning areas (such as areas where spawning was observed in the past) during the spawning period. Electrofishing will be conducted on a very limited basis only during the months when juvenile steelhead and Upper Columbia River ESU spring chinook salmon are not expected to be present (November through May). Furthermore, electrofishing will be conducted using amperages below the level likely to affect adult steelhead or salmon. Consequently, no protected salmon or steelhead will be subject to harassment as a result of any Hanford Site project.

Capture

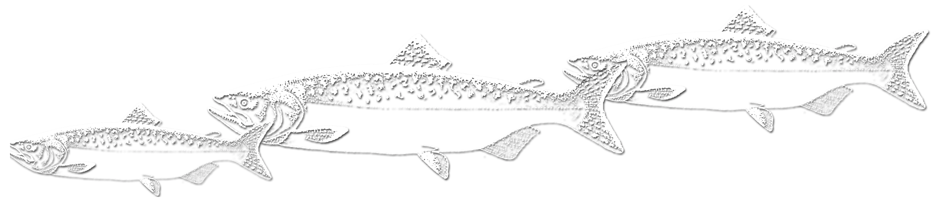
Electrofishing constitutes the only Hanford activity that could result in capture. Electrofishing will be conducted as described in the preceding subsection. Consequently, no Upper Columbia River ESU spring chinook salmon or protected steelhead will be captured incidentally during any Hanford project.

Project Impact Summaries and Findings

Table 5 presents the summary findings for each project category listed in the previous section. Additionally, mitigation or other qualifications are identified for each project category that, if implemented, will maintain conditions supporting the findings.

Table 5. Findings and Mitigation/Qualifications for Hanford Projects.

Project	Findings	Mitigation/Qualifications
Water Withdrawals	Not likely to adversely affect	•Obtain Hydraulic Project Approval before cleaning screens by divers.
Discharges to Columbia River	Will not affect	•Conduct annual evaluation of discharge outfalls per NPDES.
Public Access	Not likely to adversely affect	•Design boat ramps within the design criteria for shoreline and surface runoff. •Limit shoreline modifications to within design criteria for shoreline and surface runoff, including use of Best Management Practices and following the Stormwater Pollution Prevention Plan.
Groundwater Monitoring	Will not affect	•Avoid sensitive habitats and critical periods for work in riverbed. •Minimize area disturbed.
Groundwater Treatment	Will not affect	•Monitor projects to ensure that the groundwater plume does not exceed Washington State ambient water quality standards. •Monitor projects to ensure that the magnitude or spatial extent of the water flow within the river bed will not be altered in known or potential steelhead spawning areas. •Installation of permeable barriers within 30 m of the shoreline will require separate Section 7 consultation with NMFS.
Waste Site Remediation	Will not affect	•Avoid sensitive habitats and critical periods for work in riverbed or within 30 m of shoreline. •Minimize area disturbed. •Keep shoreline remediation projects within the design criteria for shoreline and surface runoff, including use of Best Management Practices and following the Stormwater Pollution Prevention Plan. •Removal of discharge pipes in the river will require separate Section 7 consultation with NMFS.
Cultural Resource Research and Monitoring	Will not affect	•All sampling activities will be carried out away from steelhead redds.
Ecological Research and Monitoring	Will not affect	•Electrofishing will be limited to times of year when steelhead and Upper Columbia River ESU spring-run chinook salmon are not present, and will use amperages below levels that would affect adult steelhead. •All sampling activities will be carried out away from steelhead redds.



DOE Management for Protecting Salmon and Steelhead on the Hanford Site

This section defines the substantive requirements and management procedures for protecting habitat of Upper Columbia River ESU spring chinook salmon and steelhead within the Hanford Site. These requirements and procedures pertain to DOE and its contractors as they perform work under their operations contracts with DOE.

One way DOE will ensure this Plan is implemented is through the National Environmental Policy Act (NEPA) review process that is conducted on all Hanford projects. One aspect of the NEPA review process is the Ecological Compliance Review, which evaluates proposed projects against regulatory criteria and DOE natural resource management goals.

Habitat

The DOE 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. Consistent with this belief, every effort will be taken to ensure that DOE and its contractors conduct activities that preserve, protect, and perpetuate salmon and steelhead habitat. This will include following project-specific Best Management Practices (described below), developing management and land-use decisions within the context of protecting salmonid habitat, and consistently enforcing the scope and intent of this Management Plan.

The DOE is currently implementing a *Biological Resources Management Plan* (BRMaP [DOE 1996]) for the entire Hanford Site. Included in the BRMaP are specific objectives and strategies that describe how DOE intends to protect biological resources and to monitor, assess, and mitigate the impact to biological resources from Site activities. DOE will amend BRMaP to include tasks to monitor and characterize salmonid habitat. This may include annual spawning surveys, habitat evaluation, and contaminant monitoring. Creating spawning habitat is not currently a part of BRMaP, although all DOE projects are required to perform in-kind replacement of all riparian habitats that are disturbed by DOE projects. Riparian areas and the Columbia River are among the habitats with the highest priority for protection.

Where possible, projects will be designed and conducted not to exceed the critical criteria levels described in the previous section. In addition, contractors conducting work on the Hanford Site under the funding authority of DOE will follow all above criteria and the management procedures described below.

Where possible, activities will be conducted during time periods or at places that avoid contact with steelhead and protected salmon. This is possible by conducting instream work during an approved "fish window" and avoiding steelhead spawning areas. From Priest Rapids Dam to approximately Ringold, the window for major work is August 1 through mid-October. This window is designed to minimize impacts to eggs and emergent fry. Downstream of Ringold, the preferred work window is late November through mid-March. Depending on the nature of the instream activity, project-specific modifications to the work window can be made under the approval and supervision of the Ecological Compliance Assessment Project.

Good planning and construction practices will be used to prevent impacts to Upper Columbia River ESU spring chinook salmon and steelhead. For example, properly maintaining equipment to prevent petroleum products from entering water, 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 the project that are beneficial for fish and wildlife habitat.

Activity-specific management practices that will prevent impact to salmonids are described below.

Water Withdrawal Activities

All projects will minimize water withdrawals from the Columbia River and ensure that all withdrawals meet the state of Washington screening criteria or equivalent operational goals.

Discharge of Material to the Columbia River

All material discharged to the Columbia River will meet the NPDES permit for that discharge. To ensure that no impacts occur, no material will be discharged directly into steelhead spawning areas even if it meets the NPDES permit.

Shoreline and Riverbed Modifications

Removal of native riparian or emergent vegetation will be minimized, and necessary projects will be located in areas where vegetation is already disturbed. Damaged vegetation will be replaced with native plants for erosion protection. Where possible, hand-tools will be used for in-water work. In all cases, the use of heavy equipment below the ordinary high water line will be minimized.

Complex shorelines and riverbed features provide refuge for many life stages of steelhead and salmon, including emergent fry, yearlings, and adults. Where possible, projects that result in simplification of shoreline structure will not be constructed. Modifications will be limited to shoreline areas that have been previously disturbed, or will maintain as much as possible the natural shoreline configuration, and/or will incorporate mitigative measures into project design. Increased silt production upstream of steelhead spawning areas will not be allowed.

Bank protection will be done using bioengineering rather than hard armor. Banks will be shaped at a 3:1 slope and consider effective rooting zone of plants used for bioengineering. Structures and/or modifications beneficial to fish or wildlife habitat (e.g., soil bioengineering, biotechnical design, or rock barbs) as approved by WDFW will be incorporated into projects where it is feasible to do so.

Hydrologic and soil conditions that support wetland vegetation will be maintained and reestablished after any construction in wetland areas. Construction management will ensure that soil to be removed in wetland or floodplain areas be stockpiled separately from subsurface soil, that compaction of hydric soil be minimized, and that subsurface soil be replaced first followed by the upper layer last.

Dredging will not be allowed without prior review by the Ecological Compliance Assessment Project. Section 7 consultation with the NMFS may be required.

Surface Runoff

Surface runoff will be minimized by avoiding impact to shoreline vegetation. Removal of native riparian or emergent vegetation will be minimized, and projects will be located in areas previously disturbed. Adherence to a stormwater management plan will be required to prevent any runoff to the Columbia River. As described previously, native shoreline vegetation will be used to prevent surface runoff after construction is completed.

Modification of Existing Groundwater Plumes

Management of existing groundwater cleanup activities within the criteria specified in the previous section will prevent adverse impacts to steelhead and salmon.

Harassment

Disruptive activities will be avoided during the period when Upper Columbia River ESU spring chinook salmon or steelhead are present.

Capture

Under no circumstances will steelhead or Upper Columbia River ESU chinook salmon purposely be captured without undergoing Section 7 consultation with the appropriate federal agency. Activities will not be conducted in such a way that incidental capture is likely.

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