LAKE RIVER BRIDGE REPLACEMENT

BIOLOGICAL ASSESSMENT

US FISH AND WILDLIFE SERVICE
RIDGEFIELD NATIONAL WILDLIFE REFUGE

FEDERAL HIGHWAYS ADMINISTRATION
WESTERN FEDERAL LANDS DIVISION

PREPARED BY

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Executive Summary

The Federal Highway Administration (FHWA) in partnership with the U.S. Fish and Wildlife Service (USFWS) is proposing to improve access to the River S Unit of the Ridgefield National Wildlife Refuge (NWR) by constructing a new bridge over Lake River along the same alignment. The new bridge would replace an existing bridge that has been in place since the late 1950s.

The Ridgefield NWR was established in 1965 for the conservation of dusky Canada geese and other waterfowl. It contains over 5,000 acres of pastures, wetlands, riparian and bottomland forest, and oak woodlands. There are five management units on the Ridgefield NWR: the Roth, Ridgeport Dairy, Carty, River S, and Bachelor Island Units. The River S Unit is popular for the wildlife observation along the Auto Tour Route (seasonally walkable) as well as for hunters during the permitted hunting season. The River S Unit sees as many as 120 vehicle trips per day (USFWS 2009) during summer months.

The Lake River Bridge provides the only access over Lake River to the Unit S portion of the Ridgefield NWR. Routine refuge operations such as mowing, invasive species removal, tree planting, flooding and draining wetlands, and regulating visitor and hunter use require use of the Bridge. The existing bridge is constructed with trestle bents and abutments containing timber and steel piles, and timber bracing and caps. The bridge deck is 16 feet wide and functions as two-way single lane bridge. The bridge has been subject to frequent upgrades and repairs since it was constructed. These repairs have been necessary to keep the bridge open to the public. In the 1990s, the replacement piles were constructed, the electrical line across the bridge was upgraded, and running planks were replaced on the deck. In the 2000s, the bridge's west abutment was reconstructed and guardrails were replaced. FHWA Bridge Engineers estimated the bridge's serviceable life span of 5-10 years based on the 2010 inspection report. This means that without repairs or reconstruction in the next 1-6 years, the bridge may not be safe for public or refuge use and would need to be closed.

Recognizing the importance of the access provided by the Lake River bridge, the USFWS conducted an alternative analysis that considered relocating the bridge closer to the city of Ridgefield. But it was determined that replacing the existing bridge with a new bridge along the same alignment was the most feasible.

Fish species listed under the Endangered Species Act that may occur in Lake River includes Lower Columbia River (LCR) coho, LCR Chinook, LCR steelhead, Columbia River chum, and eulachon. Lake River mainly functions as a migration corridor to spawning and rearing in upstream tributaries (e.g. Salmon Creek). In-water construction activities, such as pile driving or drilled shaft installation, may adversely affect coho, Chinook, and steelhead if they are present in the action area during in-water construction activities. The project is not likely to adversely affect chum or eulachon due to lack of presence in the action area.

Overall the project would improve Lake River by removing creosote treated piles associated with the old bridge from the river. These treated piles are a chronic source of water contamination and their removal will be beneficial to Lake River water quality. The new bridge will also have a greater span, fewer in-stream structures and less floodplain fill than the existing bridge. Disturbed riparian areas will be replanted with native vegetation.

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Chapter 1: Project Overview

The US Fish and Wildlife Service (USFWS) is partnering with the Federal Highway Administration (FHWA), Western Federal Lands Highway Division, to improve access to the Ridgefield National Wildlife Refuge (NWR) in southwest Washington by replacing the structurally deficient Lake River Bridge with a new bridge along the same alignment. USFWS identified the need for access improvements to the refuge in their Comprehensive Conservation Plan (USFWS 2009) which called for considerations of a new access point to the refuge that could provide long term reliability for public access while meeting USFWS' operational needs. The existing access crosses a single lane bridge with a narrow passage that can be difficult for passenger vehicles and buses to access the refuge. The crossing is also complicated by an at-grade crossing of the BNSF railway on the eastern side of the bridge, and cars often pause on the railroad tracks to wait for oncoming traffic to clear the bridge. The narrow bridge also makes ongoing refuge operations difficult because USFWS stores most of their heavy equipment (e.g. farm tractors) off site and must cross the bridge regularly. Seeking to alleviate these concerns regarding access, FHWA undertook an in-depth transportation analysis to assess the current access location and identify specific alternatives that could improve access while being both economically and environmentally sustainable. In the end, FHWA considered 23 alternatives but determined that replacing the Lake River Bridge along the same alignment and creating an overcrossing of the railroad was the most feasible.

1.1 Federal Nexus

Section 7 of the Endangered Species Act (ESA) requires federal agencies to consult with the National Marine Fisheries Service (NMFS) for marine and anadromous species, and the USFWS for freshwater species and wildlife, if there is a proposed "action" that may affect ESA-listed species or their designated critical habitat. An "action" is defined broadly to include funding, permitting, and other regulatory actions (50 Code of Federal Regulations [CFR] 402.02). For this project, USFWS Road Funds is providing funding to FHWA for preliminary engineering for the bridge replacement. FHWA will serve as lead federal agency of Section 7 consultation with NMFS for listed fish species. USFWS Ridgefield NWR will conduct intra-agency consultation for ESA listed species managed by USFWS.

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires federal agencies to consult with NMFS on all activities or proposed activities authorized, funded, or undertaken by the agency that may adversely affect essential fish habitat (EFH). Analysis of EFH related to this project is provided in Appendix A.

1.2 Project Description

The project will replace the existing, trestle-style Lake River Bridge with a new bridge immediately to the south of the existing bridge (Figure 1). The new structure will be a four-span bridge supported on drilled shaft piers. It will be approximately 500 feet long to span both the US Coast Guard navigation channel of Lake River and the BNSF railroad tracks east of the bridge. Each bent will be founded on large-diameter

drilled shafts that will be sufficiently embedded within the soil for structure stability. For preliminary designs, the shafts are estimated to be 8-foot-diameter and 50 feet below ground line. Two piers (Pier 1 and Pier 2) will be placed in the river channel with a third pier outside of the river channel on the eastern streambank to support the railroad overcrossing portion of the bridge. Bridge abutments will be setback from the edge of Lake River about 50 feet to the west and 200 feet to the east. The total bridge width will be 32 feet wide, and will include two 12-foot travel lanes plus a 2-foot wide pedestrian walkway. The bridge superstructure will be built of precast concrete girders with a cast-in-place deck. Construction requires the use of a temporary work bridge supported on about 150 piles (108 in-water piles) to facilitate construction of the mid-channel piers. The temporary work bridge would remain in place for approximately one year. The existing bridge will remain in place during construction and continue to be used for public access. Following construction the old bridge will be demolished.

The project is expected to last two years and involves both in-water work and upland work elements. In-water work involves installation of the temporary work bridge, construction of in-water bridge foundations, and removing the existing bridge. To minimize construction duration, The project proposes an in-water work window dependent upon the activity as shown in Table 7. The timing of in-water work presented in Table 6 was developed considering recommended in-water work periods from Washington Department of Fish and Wildlife (WDFW) and US Army Corps of Engineers (USACE), and discussions with local agency biologists. Upland work involves establishment of on-site staging areas and construction access, traffic control, construction of bridge super structure, roadwork and paving, installation of new stormwater facilities, and on-site restoration and enhancement.

Figure 1 – Existing Bridge

1.3 Project Area and Setting

The project is located in the Salmon Creek / Lake River Basin in the River S Unit of the Ridgefield NWR in southwestern Washington (Table 1). Lake River is approximately 10 miles in length running parallel to the Columbia River. It flows north from Vancouver Lake to the northern tip of Bachelor Island. Lake River is a tidally influenced river and a navigable waterway under jurisdiction of the U.S. Army Corps of Engineers (USACE), USCG, and the State of Washington's Departments of Ecology and Natural Resources. According to the USCG's Navigability Determinations for the Thirteenth District, Lake River is tidally influenced up to the bridge at milepost (MP) 3.3. Lake River is also listed under a 1925 congressional action through the USACE for a dredge authorization to MP 2.5. USACE maps of the dredged channel indicate the dredging limit at MP 3.0.

An aerial photograph from 1960 shows the existing bridge in its current location. The bridge was most likely constructed in the late 1950's. The bridge structure is constructed with trestle bents and abutments containing timber and steel piles, and timber bracing and caps. The bridge provides access to the River 'S' Unit auto tour route (Figure 2). This 4.2 mile gravel road loop is open during daylight hours only and limited to 200 cars per day according to the refuge's Comprehensive Conservation Plan (USFWS 2009)

Construction activities will affect land owned by USFWS (parcel no. 218764000), BNSF Railroad (no parcel number), City of Ridgefield (216032000), and a private landowner (220010000). The landscape setting near the project is mainly undeveloped with dense vegetation and riparian wetlands along Lake River that transition into agricultural and suburban landscapes around Ridgefield, WA. The City of Ridgefield supports a population of about 5,000 people, with an urban center just north of the project area.

Table 1 – Project Location

Description	Location
Township, range, section	Township 4 west, Range 1 east, Section 30
Nearest city	Ridgefield, WA
County	Clark County, WA
WRIA	28 – Salmon/Washougal
HUC (5th field)	1709001203 Salmon Creek/Frontal Columbia River
Latitude/longitude	N45º 48.438'/ W122º 44.434'
Land ownership	USFWS, private, BNSF Railroad, City of Vancouver

1.4 Consultation History

FHWA (Steve Morrow and Michael Traffalis) conducted an onsite meeting with the WSDOT-NMFS Liaison (Michael MacDonald) on May 28, 2014. Topics discussed included timing of in-water work, pile driving methods, installation of drilled shafts, and fish presence. Email correspondence between agencies is provided in Appendix D.

There is differing guidance regarding the suggested timing of in-water work in Lake River. The WDFW (2010) suggest that spawning or incubating salmonids "are least likely to be within" Lake River year round (January 1 – December 31), although fish are expected to migrate past the bridge to upstream tributaries (e.g. Salmon Creek). While the USACE recommends an "approved work window for fish protection" for Lake River between June 1 and October 31. Based on these recommendations and input from WDFW, the project may complete in-water work activities, except impact pile driving, at anytime. Impact pile driving will be restricted to between June 1 and September 15. This timing will allow the bridge replacement be completed over a shorter time period while limiting impact pile driving to the summer period when fish are less likely to be migrating through the action area.

NMFS asked if piles for the temporary bridge could be placed only using vibratory pile driver, thus avoiding the impacts associated with impact pile driving. However, based on input from FHWA's geotechnical specialist, the geology at the site is unable to support non-load tested piles for the temporary bridge. The project will use noise attenuation devices to reduce noise levels during impact pile driving.

NMFS suggested the contractor implement fish exclusion measures to minimize the chance of trapping fish in the large casings used for the drilled shafts. In response, FHWA will require the contractor to

provide a qualified biologist to design and conduct fish exclusion measures according to WSDOT Fish Exclusion Protocols and Standards (Appendix A).

FHWA consulted with WDFW (Anne Friesz) regarding the use of Lake River by coho. WDFW characterizes Lake River as through-way for fish migrating to upstream habitats but Lake River itself is slack water habitat with silty substrate that does not contain many of the habitat attributes associated with spawning or rearing coho. Sampling in Salmon Creek found few coho but WDFW suggested that coho may occur in Lake River during upstream migration between October 1 and January 31.

Tribal correspondence is also included in Appendix D.

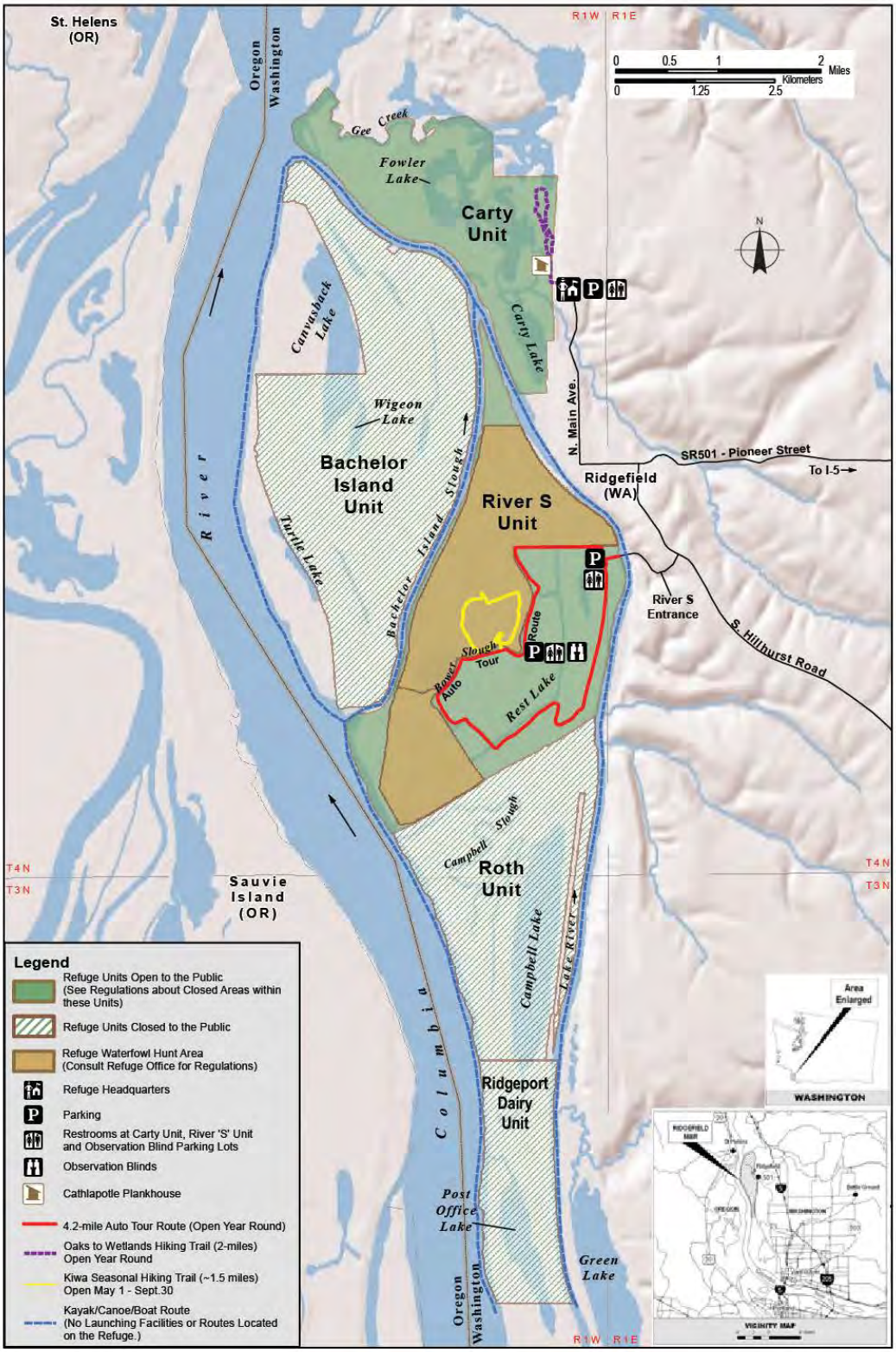

Figure 2 – Ridgefield National Wildlife Refuge

Chapter 2: Federally Listed Species and Designated Critical Habitat

In the Columbia River, NMFS has listed 15 fish populations as threatened or endangered under the ESA. In the lower Columbia River domain (includes Columbia River up to Bonneville Dam and its tributaries, excluding Willamette River above Willamette Falls), there are five listed fish species. Each of those five species may occur in the project vicinity (Table 2, Appendix C). FHWA determined the presence of ESA-listed species and designated critical habitat that may be occur near the project comparing the list of threatened and endangered species under NMFS' jurisdiction to the action area (Chapter 5:). Information distribution and occurrence of ESA-listed species and critical habitat in the action area was confirmed using data available from NMFS' Northwest Regional Office website, the map databases of Streamnet (www.streamnet.org/) and WDFW's SalmonScape (apps.wdfw.wa.gov/salmonscape/), Salmon Stock Inventory for WRIA 28 (Appendix D), and recent Environmental Assessments involving the Ridgefield NWR (USFWS 2014a, 2014b). Based on these sources, FHWA determined that winter steelhead (*Oncorhynchus mykiss*) of the Lower Columbia River (LCR) Distinct Population Segment (DPS), LCR fall Chinook (*O. tshawytscha*) Evolutionarily Significant Unit (ESU), chum (*O. keta*), coho (*O. kisutch*), and eulachon (*Thaleichthys pacificus*) and their critical habitat, are the five ESA-listed species under NMFS's jurisdiction that may occur in the action area (Figure 8). This finding concurs with USFWS (2010) that reports:

> …several species/stocks of anadromous fish including coastal cutthroat trout, Chinook and coho salmon and steelhead spend portions of their life history either on or adjacent to refuge waters and shorelines on the Columbia River. Historically, Gee Creek, Campbell Slough, Lake River, Bachelor Slough, and shallow overflow lakes such as Campbell Lake served as nurseries for young developing salmonids. Spawning chum salmon were noted in a tributary of Gee Creek in the late 1940s, and there was an anecdotal account of coho salmon trying to get past a barrier near Royle Road on Gee Creek prior to the 1950s.

Table 2 – ESA listed fish that may occur in the vicinity of the project

Species	Status	Listing	Critical Habitat Designation	Applicable Regulations
Lower Columbia River Coho Salmon	Threatened	June 28, 2005; 70 FR 37160	Not yet established	June 28, 2005; 70 FR 37160
Lower Columbia River Chinook Salmon	Threatened	March 24, 1999; FR 14308	February 16, 2000; 65 FR 7764	July 10, 2000; 65 FR 42422; June 28, 2005; 70 FR 37160
Columbia River Chum Salmon	Threatened	March 25, 1999, 64 FR 14508	February 16, 2000; 65 FR 7764	July 10, 2000; 65 FR 42422; June 28, 2005; 70 FR 37160
Lower Columbia River Steelhead Trout	Threatened	March 19, 1998; 65 FR 13347	February 16, 2000; 65 FR 7764	July 10, 2000; 65 FR 42422 June 28, 2005; 70 FR 37160
Eulachon	Threatened	Federal candidate Species	Oct	73 FR 13185; March 12, 2008

The timing of ESA-listed fish that may occur in the action area varies by species (Table 3).

Table 3 – Fish run timing in Lower Columbia River (LCFRB 2010)

	Month											
	Jan	Feb	Mar	Apr	May	Jun[1]	Jul[1]	Aug[1]	Sep[1]	Oct	Nov	Dec
Coho												
Adults enter freshwater												
Spawning												
Egg incubation												
Fry emergence/early rearing												
Fry migration/rearing												
Ocean entry												
Fall Chinook												
Adults enter freshwater												
Spawning												
Egg incubation												
Fry emergence/early rearing												
Fry migration/rearing												
Ocean entry												
Chum												
Adults enter freshwater												
Spawning												
Egg incubation												
Fry emergence/early rearing												
Fry migration/rearing												
Winter steelhead												
Adults enter freshwater												
Spawning												
Egg incubation												
Fry emergence/early rearing												
Fry migration/rearing												
Eulachon												
Adult upstream migration												
Larval downstream migration												

[1] Instream impact pile driving would occur from June 1 – September 15

Fish species that migrate through the Columbia River but are not part of the LCR domain or known to occur in Lake River (or its tributaries) will not be affected by the project because the distribution of these fish does not overlap with the action area. Therefore, the project will have no effect on the following species: Upper Willamette River Chinook, Upper Willamette River steelhead, Middle Columbia River steelhead, Snake River sockeye, Snake River Fall Chinook, Snake River Spring/Summer Chinook, Snake River steelhead, Upper Columbia River Spring Chinook, Upper Columbia River steelhead, Southern DPS green sturgeon, and Columbia River bull trout. For those species that may occur in the action area, the following sections describe species life history information and biological requirements, factors limiting the species, and information about the presence of each species within the action area.

2.1 Lower Columbia River Coho

2.1.1 Status and Life History

NMFS listed the LCR coho salmon as threatened under the ESA in June 2005 (NMFS, 2005b). This ESU includes all naturally spawned populations of coho salmon from Columbia River tributaries below the Klickitat River on the Washington side and below the Deschutes River on the Oregon side (including the Willamette River as far upriver as Willamette Falls), as well as coastal drainages in southwest Washington between the Columbia River and Point Grenville . According to McElhany et al. (2007), most of this ESU is dependent on hatchery-produced fish, including the Lewis River. The LCR coho ESU is dominated by hatchery production. The vast majority (more than 90 percent) of the historical populations in the LCR coho ESU appear to be either extirpated or nearly so (West Coast Biological Review Team [WCBRT], 2003).

Lower Columbia River coho are typically categorized into early and late returning stocks. Early-returning (Type S) coho enter the Columbia River in mid-August and begin entering tributaries in early September, with peak spawning from mid-October to early November. Late-returning (Type N) coho pass through the lower Columbia from late September through December and enter tributaries from October through January. Most spawning occurs from November to January, but some spawning ranges to February and as late as March. A complete account of coho life history is presented in Sandercock (1991) and LCFRB (2010).

According to LCFRB (2010), “coho historically utilized almost every accessible stream tributary in the lower Columbia River. Coho particularly favor small, rain-driven, lower elevation streams characterized by relatively low flows during late summer and early fall, and increased river flows and decreased water temperatures.” Returning fish rely on rainfall events to provide tributaries with enough water to allow fish to move upstream, so fish are often found milling near the river mouths or in lower river pools until the first fall freshets. This behavior may occur in Lake River as fish stage prior to entering Salmon Creek.

2.1.2 Occurrence in Action Area

Adults migrate upstream from October to January and may cross the action area on their way upstream to Salmon Creek (Table 3). In 2011, WDFW conducted spawning ground surveys on 62 miles of Salmon Creek and its tributaries and estimated that about 205 spawners per mile occur in the Salmon Creek

watershed (although not in the action area; WDFW 2013). All observations were of natural-origin fish, and there were no indications of hatchery origin fish occurring in the Salmon Creek system. The Lower Columbia Salmon and Steelhead Recovery and Subbasin Plan (Northwest Council 2004) states that coho spawn throughout the Salmon Creek basin, but principally in the upper mainstem Salmon, and Morgan, Rock, Mill, and Weaver Creeks. Lake River lacks suitable substrate or flow for spawning, so spawning and egg incubation are not expected to occur in the action area (WDFW 2010).

After spawning occurs in Salmon Creek and eggs incubate over the late fall and winter, coho fry emerge and move to shallow, low-velocity rearing areas, primarily along the stream edges and in side channels. According to LCFRB (2010), "juvenile coho favor pool habitat and often congregate in quiet backwaters, side channels, and small creeks with riparian cover and woody debris. Side channel rearing areas are particularly critical for overwinter survival of coho which is also a key regulator of freshwater productivity." Since coho juveniles rear in freshwater for more than a year, Lake River may function as rearing habitat for Salmon Creek-born individuals, as it provides slack water habitat with shallow margins. But coho may also be more susceptible to predation in Lake River, as predators such as northern pikeminnow or small mouth bass are more likely to occur in Lake River than Salmon Creek. Rearing juveniles could be expected to occur in the action area year round, depending on water temperature. Instream temperatures may preclude extensive rearing in the summer months (see Section 3 for a discussion of temperature). Out migrating juveniles may be present in the action area from mid-February to mid-September, with peak use between April and June. Substrate in the action area is primarily sand and silt which is not suitable for coho spawning.

2.1.3 Critical Habitat

Critical habitat for LCR coho salmon was proposed on January 14, 2013 but has yet to be finalized. Lake River is included in the proposed designation. Lake River will be presumably included as critical habitat when the designation is finalized.

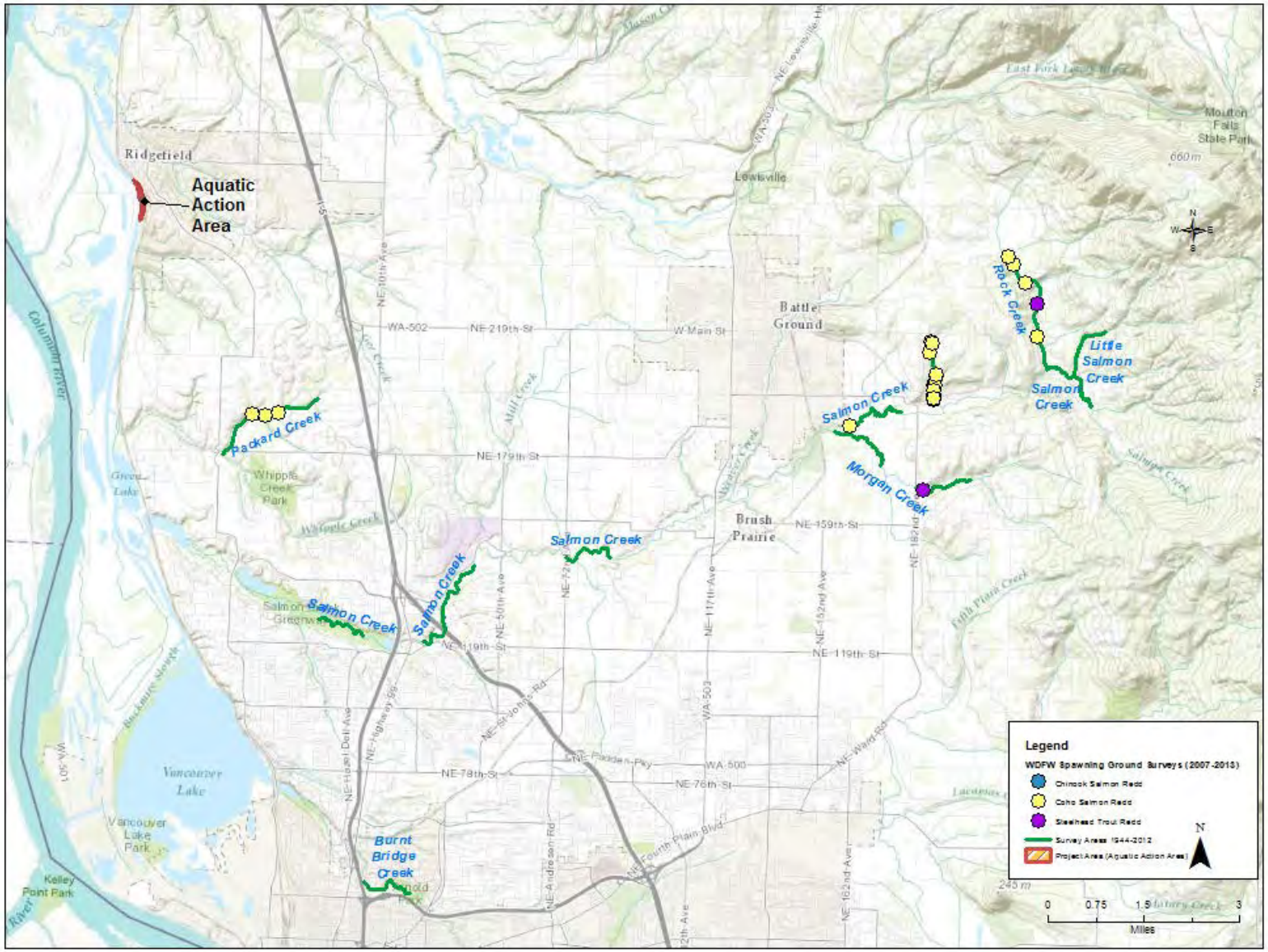

Figure 3 – WDFW Spawning Ground Surveys

2.2 Lower Columbia River Fall Chinook

2.2.1 Status and Life History

In March 1999, NMFS listed LCR Chinook salmon as threatened under the ESA (NMFS, 1999a), and reaffirmed in 2005. This ESU includes all naturally spawning populations from spring and fall Chinook from the Columbia River from its mouth at the Pacific Ocean upstream to a point east of the White Salmon Creek. The eastern boundary of this ESU correlates to the historic Celilo Falls, which is thought to be the original migration barrier to Chinook salmon at certain times of the year and is currently submerged beneath the reservoir behind The Dalles Dam. The ESU excludes Chinook populations above Willamette Falls. “Tule” fall Chinook salmon in the Wind and Little White Salmon rivers are included in this ESU.

Generally, fall Chinook upstream migration in the Columbia River begins in August or September, depending on early rainfall, and spawn from late September to November (Table 3). A late fall run (i.e. lower river brights) return slightly later to spawn from November to January. These late arrive Chinook are mostly found in the Lewis River and several gorge tributaries, but the Salmon Creek basins supports early spawning Chinook (i.e. tule population). Substrate in the action area is primarily sand and silt which is not suitable for Chinook spawning.

Juvenile rearing occurs near and downstream of the spawning areas. Juveniles migrate from Salmon Creek in the spring and early summer of their first year. Fry emerge around early April, depending on time of egg deposition and water temperature; fall Chinook fry spend the spring in fresh water, and emigrate in the summer as sub-yearlings. A complete account of Chinook life history in general is presented in Healy (1991).

2.2.2 Occurrence in Action Area

Only fall Chinook have the potential to occur in Lake River, according to WDFW’s SalmonScape database. Fall Chinook spawn in most large tributaries to the lower Columbia River and historically spawned in the lower 5 miles of Salmon Creek and lowest reach of Burnt Bridge Creek. However, historical spawning populations were thought to be small. The LCFRB (2010) estimated that 100-400 fish returned each year to the Salmon Creek basin. Given these low numbers and degraded habitat from urban development, the Salmon Creek Chinook population was ranked as having “low” viability in the Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan (LCFRB 2010). Therefore, in consideration of low population numbers and juvenile outmigration timing, the likelihood for Chinook presence in Lake River during instream construction is low. Still, some adults may migrate through the action area during instream work, including pile driving.

2.2.3 Critical Habitat

NMFS designated critical habitat for LCR Chinook salmon in September 2005 (NMFS, 2005d). The specific critical habitat units (CHUs) in the action area includes the Columbia River from latitude 46.2485,

longitude –124.0782, upstream to an endpoint in the Columbia River at latitude 45.5709, longitude –122.4021.

2.3 Columbia River Chum

2.3.1 Status and Life History

NMFS listed the Columbia River chum salmon ESU as threatened in March 1999, (NMFS, 1999b) and reaffirmed their status in June 2005 (NMFS, 2005b). In the vicinity of the action area, the Columbia River chum ESU occurs downstream of Bonneville Dam and in nearby tributary streams of the Columbia Gorge and downstream in the estuary reach of the Columbia River. According to WDFW, current populations of chum are centered on Grays River and the area below Bonneville Dam. Chum use the lower portion of Grays River and Grays River tributaries Crazy Johnson and Gorley creeks. Near Bonneville Dam, chum spawn in Hamilton and Hardy creeks plus the Columbia River mainstem near Ives Island. Entry of adults into freshwater at the mouth of the Columbia occurs from October through December. Entry into Grays River peaks in November. At Hamilton and Hardy Creeks entry is later, peaking in December. Peak spawning time is from mid-November to early-December on Grays River. Spawning peaks later for the Hamilton and Hardy populations and its peak is generally in late December.

Emergence is likely to occur between February and April. Outmigration occurs from March through May of the same year. Peak outmigration from Hardy Creek occurs in April. There are three artificial propagation programs producing chum salmon as conservation programs designed to support natural production (70 FR 37189). In particular, the Washougal Hatchery artificial propagation program provides artificially propagated chum salmon for re-introduction into recently restored habitat in Duncan Creek

and the overall Columbia River population is believed to be small.

2.3.2 Occurrence in Action Area

Chum historically occurred in many lower Columbia River tributaries, including Lake River. Today, the distribution of chum is restricted to a few spawning areas (Grays River and Bonneville Dam area) and the he occurrence of chum in action area is unlikely. WDFW's SalmonScape database lists chum presence in Lake River as "presumed" based on historical use. Chum spawn in low-gradient, low-elevation streams and rivers, and spawning sites are often correlated with the presence of groundwater upwelling (McElhany et al 2007). When hatched, chum fry move downstream rapidly, primarily at night. Studies on the Grays River show that when hatched, fry of chum salmon migrated rapidly through the system, whereas Chinook and coho resided from March to at least July (Roegner et.al. 2010).

The widespread urban development in the Salmon Creek basin has significantly reduced the spawning habitat for chum through stream sedimentation, channel alteration, and loss of floodplain connectivity, especially along low elevation stream preferred by chum (LCFRB 2010). McElhany et al (2007) speculate that the since "much of the human population in the region lives in the low elevation, low gradient environment historically used by chum…there has been substantial impact on potential spatial structure for chum." Due to the widespread loss of low elevation stream habitat along the lower Columbia River,

approximately 90 percent of the historical populations in the Columbia River are extirpated or nearly so, and remnant populations are isolated to a few locations (70 FR 37189). Based on WDFW survey data and interviews with local biologist, chum have not been observed in Salmon Creek or Burnt Bridge Creek in the last 10 years (pers comm, Lisa Brown, WDFW). There nearest known spawning area is the Washington shoreline of the Columbia River just upstream of the I-205 bridge, approximately 20 miles upstream from the action area.

LCFRB (2010) states "there is currently no significant spawning by chum salmon in [Salmon Creek] basin and prospects for restoration of significant chum habitat are limited in this urbanized subbasin." The current natural spawning for chum in the Salmon Creek basin is believed to be less than 100 fish (LCFRB 2010). Historically, chum spawned in the lower reaches of Salmon Creek, Gee Creek, Whipple Creek and Burnt Bridge Creek, but now only remnant populations that spawn in Washington tributaries near Bonneville Dam, Hamilton and Hardy creeks in particular (WDFW, 2008; Appendix C). According to WDFW spawning ground data from 2011 to 2013 (includes over 100 survey efforts on various stream reaches), no chum have been observed in Salmon Creek or Burnt Bridge Creek. Also, there were no incidental observations of chum at WDFW's weir on Salmon Creek (RM 5.9) while sampling during the spring and fall 2009-2010 (pers comm Julie Grobelny, WDFW).

Chum prefer to spawn immediately above turbulent areas or where is upwelling (Salo 1991). In the Status Review of Chum Salmon, NMFS cite a WDFW study that found chum in Washington most commonly spawn in "areas at the head of riffles" (Johnson et al 1997). Characteristics associated with chum spawning habitat – riffles or upwelling - are not present in the action area as the habitat in the action area is pool-like with sand and silt substrate..

The likelihood of chum presence in Lake River during instream construction is discountable because current research indicates that chum populations are localized to Grays River and the tributaries immediately downstream of Bonneville Dam, and habitat conditions in the action area are not suitable for chum spawning.

2.3.3 Critical Habitat

The NMFS designated critical habitat for Columbia River chum salmon in September 2005 (NMFS, 2005b), and includes Lake River and Salmon Creek. As critical habitat, Lake River contains, or may contain in the future, PCEs as a migratory corridor for chum moving upstream to spawning in tributaries. The critical habitat designation defines the lateral extent of critical habitat for each designated stream reach as the width of the stream channel as defined by its bankfull elevation (70 FR 52630 – 52858).

2.4 Lower Columbia River Steelhead

2.4.1 Status and Life History

The Lower Columbia River steelhead DPS was listed as threatened in 1997 (62 FR43937; August 18, 1997), and reaffirmed in 2005. The DPS includes all naturally spawned populations of steelhead in streams and tributaries to the Columbia River between the Cowlitz and Wind Rivers, Washington (inclusive), and the Willamette and Hood Rivers, Oregon (inclusive). Excluded are steelhead in the upper

Willamette River Basin above Willamette Falls and steelhead from the Little and Big White Salmon Rivers in Washington. Lower Columbia River O. mykiss remain listed as threatened (69 FR 33102; June 14, 2004), including resident populations of O. mykiss below impassible barriers (natural and manmade) that co-occur with anadromous populations. The listing also includes ten artificial propagation programs considered part of the DPS.

Steelhead are rainbow trout that exhibit an anadromous life history pattern. By migrating to the ocean, steelhead grow to much larger sizes than their resident cohorts. Anadromous steelhead and resident rainbow trout can be considered to be from the same population, as "anadromous parents can produce resident offspring and resident parents can produce anadromous offspring" (LCFRB 2010). This adaptive life history makes steelhead flexible to changing habitat conditions.

In the lower Columbia basin, migrating adult steelhead can occur in the Columbia River year-round, but peaks in migratory activity and differences in reproductive ecotype lend themselves to classifying steelhead into two races: summer and winter steelhead. Winter-run steelhead reach sexual maturity in the ocean, return to freshwater between November and April with well-developed gonads and spawn shortly thereafter (NMFS 2013). Juvenile steelhead in this DPS generally smolt at 2 years of age. Downstream migration of both summer-run and winter-run steelhead through the LCR begins in March, peaks in April and May, and declines through July (Dawley et al., 1986). These smolts are large in comparison with ocean-type salmonids and move quickly downstream to the ocean.

2.4.2 Occurrence in Action Area

According to (LCFRB 2010), "winter steelhead historically spawned throughout the Salmon Creek Basin, the lower reaches of Gee Creek, Whipple Creek, Burnt Bridge Creek and portions of the Lake River." The subbasin plan characterizes most of the Salmon Creek watershed as "severely degraded by urban development." While Salmon Creek is outside the action area, fish must migrate up Lake River, passing the action area, to reach Salmon Creek. Therefore, steelhead are expected to occur in the action area during adult upstream migration and downstream juvenile migration. Substrate in the action area is mainly sand and silt and does not provide suitable spawning habitat for steelhead. During the summer, high water temperature (>18°C) likely precludes use of Lake River as juvenile rearing habitat. See Section 3 for discussion of Lake River water temperature.

2.4.3 Critical Habitat

NMFS designated critical habitat for LCR steelhead in September 2005; Lake River is included in the final designation.

2.5 Eulachon

2.5.1 Status and Life History

NMFS listed the Southern DPS eulachon as threatened in March 2010 (NMFS, 2010). The southern DPS of eulachon was defined as those populations spawning in rivers south of the Nass River in British

Columbia, Canada, to (and including) the Mad River in California. Within the range of the southern DPS, the Columbia River was defined as a major production area or ‘‘core population’’ for this species. Other core populations included the Fraser River in Canada and may have historically included the Klamath River. Additional factors that may potentially limit eulachon populations include: 1) the present or threatened destruction, modification, or curtailment of its habitat or range; 2) overutilization for commercial, recreational, scientific, or educational purposes; 3) disease or predation; 4) the inadequacy of existing regulatory mechanisms; and 5) high sediment loads in spring-time water releases from a sediment retention structure on the Toutle River.

Within the Columbia River Basin, the major and most consistent spawning runs return to the mainstem of the Columbia River (from just upstream of the estuary, river mile (RM) 25, to immediately downstream of Bonneville Dam, RM 146) and in the Cowlitz River. Periodic spawning also occurs in the Grays, Skamokawa, Elochoman, Kalama, Lewis, and Sandy rivers.

Eulachon are broadcast spawners, releasing eggs over pea-sized gravel (Smith and Saalfeld 1955) and coarse sand (Langer et al. 1977). Sufficient flow may also be needed to flush silt and debris from spawning substrate surfaces to prevent suffocation of developing eggs, and Lewis et al (2002) found that eulachon preferred water velocities from 0.3 to 2.3 ft/sec (0.1 to 0.7 m/s) in the Kemano River, British Columbia. Water temperature between 4 ° C and 10°C in the Columbia River is preferred for spawning (WDFW and ODFW 2001). High water temperatures can lead to adult mortality and spawning failure (Blahm and McConnell 1971). Eulachon have also been shown to avoid polluted waters when possible (Smith and Saalfeld 1955). Shortly after hatching, the larvae are carried downstream and dispersed by estuarine and ocean currents. Juveniles are reported to rear in nearshore marine waters (WDFW and ODFW, 2001). Eulachon do not feed while in freshwater.

2.5.2 Occurrence in Action Area

The Ridgefield NWR Comprehensive Conservation Plan lists accounts of eulachon observations in Gee Creek and the Columbia River near the refuge but there is no indication that eulachon use Lake River (USFWS 2010) as the river lacks the coarse sand substrate necessary for spawning, or upstream tributaries such as Salmon Creek. Therefore, their presence in Lake River during construction is discountable.

2.5.3 Critical Habitat

Critical habitat for eulachon was designated in 2011 (76 FR 65323) and includes the Columbia River but not Lake River. NMFS defined essential physical and biological features of eulachon critical as 1) freshwater spawning and incubation sites with water flow, quality, and temperate conditions and substrate supporting spawning and incubation; 2) freshwater and estuarine migration corridors; and 3) nearshore and offshore marine foraging habitat with suitable water quality and available prey.

Chapter 3: Environmental Baseline

The environmental baseline presents an analysis of the effects of historic and ongoing human and natural factors leading to the current status of the species, their habitat (including designated critical habitat), and the ecosystem in the action area. The environmental baseline is a "snapshot" of the health of a species or its related habitat at a specified point in time (USFWS 1998). It includes a discussion of the natural habitat components of the ecosystem; however, it focuses more heavily on historical and ongoing human "stressors" on the natural environment and resultant effects on habitat potentially used by a species. The indicators of habitat quality for Pacific salmon and other aquatic species are defined in the following section in terms of the concept of properly function condition (PFC). PFC is the sustained presence of natural habitat-forming process in a watershed that is necessary for the long-term survival of the species. NMFS' Making Endangered Species Act Determination of Effect for Individual or Group Actions at the Watershed Scale (1996) provides a standardized approach for defining the biological requirements of listed species, evaluating the relevance of current baseline habitat conditions to the species' population status, and projecting possible effects from the proposed action on habitat elements important to listed species. This standardized approach, known as the "Matrix of Pathways and Indicators," uses six pathways for which human-caused actions could affect anadromous salmonid habitat. Within those pathways NMFS (1996) defined indicators that have associated quantitative metric. The pathways and indicators (listed in parenthesis) include:

- water quality (temperature, sediment/turbidity, chemical contamination/nutrients)
- habitat access (physical barriers to migration)
- habitat elements (substrate, off-channel habitat, habitat refugia, large woody debris (LWD), pool frequency, pool quality)
- channel conditions and dynamics (stream width-to-depth ratio, streambank condition, floodplain condition)
- flow/hydrology (peak/base flow, drainage network)
- watershed conditions (road density and location, disturbance history, riparian reserves)

For each indicator, NMFS defined values that correspond to three conditions levels: "properly functioning," "at risk," and "not properly functioning" used for describing the overall condition of the pathway. The Matrix of Pathways and Indicators allows a systematic characterization of baseline conditions at a watershed scale and comparison to proposed action's potential effects to fish habitat.

In general, listed fish have been adversely affected by human activities, including habitat loss due to population growth and urbanization, fishing pressure, flood control, irrigation and hydroelectric dams, pollution, municipal and industrial water use, introduced species, and hatchery production (National Research Council 1996). In addition, populations and their prey may be affected by changing climate conditions.

Agricultural, urban development, transportation networks, utility development, and forest management, among other actions, have altered the stream habitat that federally listed fish require for survival. Although single actions may not directly limit the production or fitness of listed fish populations, the cumulative effects of past actions can significantly reduce the viability of fish habitat at the watershed scale.

The project site is located near the urban centers of Ridgefield and Vancouver, Washington and the action area is made up of a mosaic of vegetation types, with most areas dominated by grassland and shrubland, but also includes urban, agricultural, aquatic, mixed and evergreen forest (Johnson and O'Neil 2001). Site photos are included in Appendix B.

Table 4 – Matrix of pathways and indicators for Lake River

Pathway	Indicator	Current Condition	Functional State
Water quality	Temperature	Listed as 303(d) impaired; Category 5 determination by State of Washington Dept. of Ecology (Ecology, 2012)	Not properly functioning
	Sediment	Sediment output from Vancouver Lake contributes to increased siltation in Lake River; high percentage of fine sediment throughout (LCFRB 2010)	Not properly functioning
	Chem. contamination	Listed as 303(d) impaired (category 5); known pollutants include PCBs, dieldrin, 4,4'DDE, fecal coliform, 2,3,7,8-TCDD. Pesticides may be entering watershed from agricultural sources. (Ecology, 2012)	Not properly functioning
Habitat access	Physical barriers	No manmade physical barriers exist (LCFRB 2010)	Properly functioning
Habitat elements	Substrate	Fine sediment is readily transported to the basin (LCFRB 2010)	Not properly functioning
	Large woody debris	Presence is low due to lack of transfer from other streams; agricultural development, diking, and road building removed riparian vegetation (LCFRB 2010)	Not properly functioning
	Pool frequency	Pool habitat lacking, due to lack of LWD, channelization, vegetation removal, dredging (LCFRB 2010)	Not properly functioning
	Off-channel habitat	Quality side-channel habitat decreased due to diking, dredging and channelization (LCFRB 2010)	At Risk

Pathway	Indicator	Current Condition	Functional State
	Refugia	Adequate refugia do not exist (LCFRB 2010)	Not properly functioning
Channel condition and dynamics	Width/depth ratio	Width to depth ratio is 15. The channel is confined by a hillside to the east, and a levee to the west.	Properly function
	Streambank condition	Diking has eliminated most riparian vegetation; erosion is high in some areas (LCFRB 2010)	At Risk/Not properly functioning
	Floodplain connectivity	Dikes, fill, and impervious surfaces impair connectivity and prevent flooding; a flushing channel connecting to Columbia River created in early 1980s (Washington Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan, 2010)	At Risk/ Not properly functioning
Flow/hydrology	Peak/base flow	Hydrologic regime of the Lake River basin has been highly impacted by urban and rural development, especially Burnt Bridge Creek, which exhibits the flashy flow typical of urban basins (Washington Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan, 2010)	Not properly functioning
	Drainage network increase	Significant increases in drainage network density due to roads (LCFRB 2010)	At risk/not properly functioning
Watershed conditions	Road density and location	Road density is a very high 9.7 mi/mi^2 in the Lake River basin, though few roads are present in the USFWS Refuge (LCFRB 2010)	Not properly functioning
	Disturbance history	Long history of disturbance to flow regime, decreased water quality, urbanization; disturbance concentrated in riparian areas (LCFRB 2010)	Not properly functioning
	Riparian reserves	74% of riparian areas are in poor condition (Lewis County GIS 2000)	Not properly functioning

Lake River is listed as a 303(d) water, meaning it is impaired and beneficial uses such as drinking, aquatic habitat, recreation and industrial use are compromised by pollution (EPA, 2013). Water quality is assessed based on a number of factors, one of which is temperature. The stream temperature of Lake River was measured in 1992 by The Stream Hydrology Technical Coordination Team and reported by the Department of Ecology. Measurements were taken in the thalweg near the Lake River Bridge, within the

action area (Ecology, 1992). The data recorded for 1992 show that the temperature dramatically increases in early spring, and reach temperatures are inhospitable to most salmonids species by summer (June to mid-September). While this monitoring data is fairly old it shows a trend of water temperatures that is unlikely changed in current conditions. In 2010, Ecology measured spring and fall water temperatures in Lake River downstream of the action area at McCuddy's marina and results from that study are consistent with Figure 4 – Lake River water temperatures.

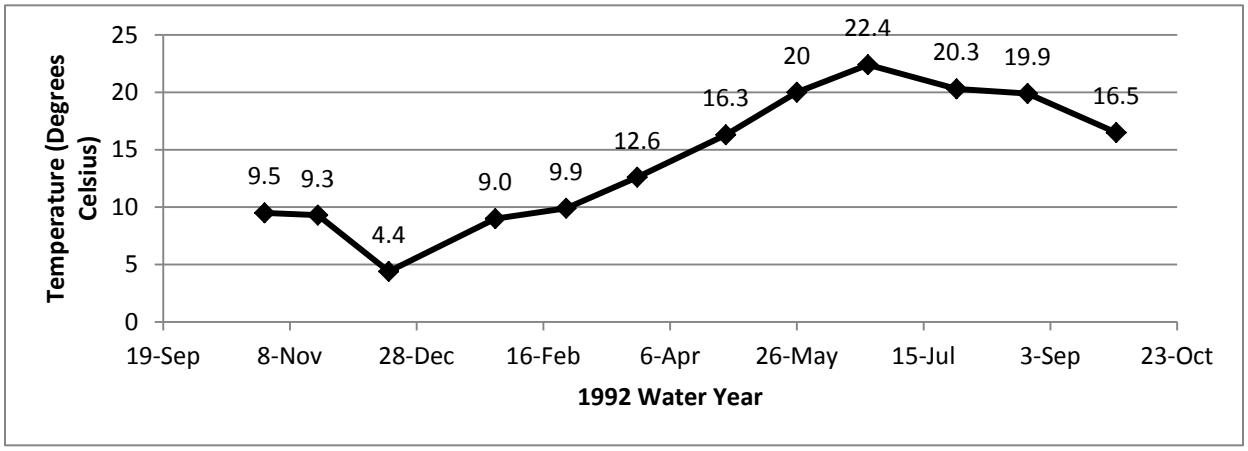

Figure 4 – Lake River water temperatures

Washington's freshwater designated uses and criteria (WAC 173-201A-200) define "core summer salmonid habitat" as stream habitat with 7-day averages of the daily maximum water temperatures (7-DADMax) that do not exceed 16°C between June 15 and September 15. Further, 7-DADMax beneficial use temperatures for salmonid rearing and migration habitat are defined as those that do not exceed 17.5°C. As shown in Figure 4, Figure 5, and Table 5 - Vancouver Lake water temperature, 2011, these temperatures are routinely exceeded during the proposed instream period for pile driving, which reduces the likelihood that rearing juveniles would be present in large numbers or for extended periods. Further, according to Salmon Creek Temperature Total Maximum Daily Load report, "the 7-DADMax temperature under current riparian conditions and normal summer weather patterns for Salmon Creek and Lake River ranged between 18.4°C and 21.8°C" (Ecology, 2011). Plus, NMFS (1996) suggests that habitat is not properly functioning for migration and rearing if water exceeds 17.8°C.

Clark County (2004) collected continuous water temperature data in Salmon Creek and its tributaries in 2003 (study area did not include Lake River), and found that 12 of the 15 monitoring stations recorded daily maximum temperatures that exceeded 17.8°C on at least 35 days during the summer (Figure 5). The summer water temperature in Lake River is likely influenced by the warm water draining from Salmon Creek.

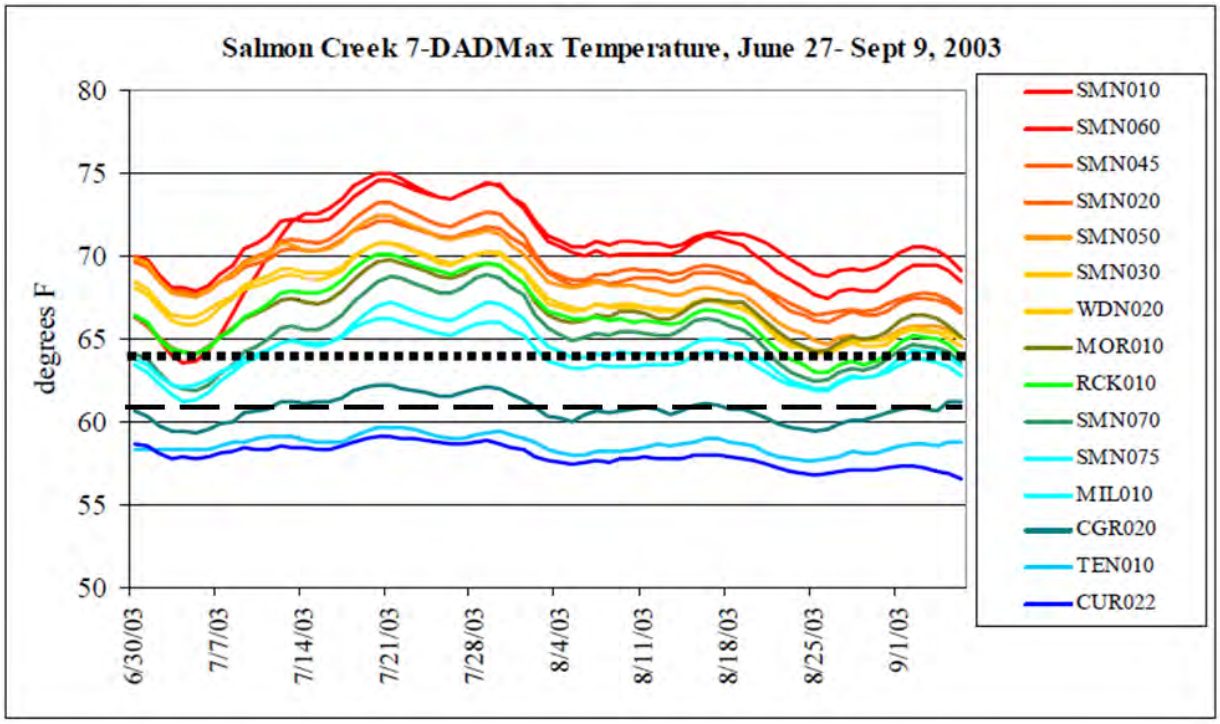

Figure 5 – 7 DADMax temperatures in Salmon Creek, summer of 2003 (Clark County 2004). Dotted line at 64°F and the dashed line at 61°F are the current numeric water quality criteria in the basin.

Water draining from Vancouver Lake into Lake River also likely contributes to high summer water temperatures at the project site. The USGS recently measured surface water temperatures in the northeast shore of Vancouver Lake (between Burnt Bridge Creek and Lake River), and also observed high surface water temperatures during the summer in 2011 (Table 5).

Table 5 - Vancouver Lake water temperature, 2011

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	--	8.8	6.5	6.0	6.4	8.2	11.9	15.9	18.9	21.6	23.2	21.2
Max	--	14.2	8.8	8.7	7.8	10.6	14.3	17.4	21.0	23.3	25.5	24.8
Min	--	3.4	4.2	3.1	4.1	4.3	10.3	14.5	16.3	19.9	21.2	18.0

Lake River is tidally influenced and often contributes flow into Vancouver Lake (USGS 2013). The water temperature in the Columbia River also ranges between 19°C and 23.5 °C during the summer (Figure 6). It is unlikely that Columbia River water influences the water temperature in Lake River at the project site, but relatively similar water temperature suggests that Lake River does not function as a thermal refugia for salmonids migrating in the Columbia River. Ecology (pers comm, Randy Coots, Ecology) measured water temperatures in Lake River during May 2010 at the McCuddy's Marinia about 0.5 miles downstream from the Lake River Bridge. During this time period water temperature varied between 12.2°C and 18.3°C. FHWA compared this water temperature data to Columbia River water levels

measured at St Helens (about 5 miles below the bridge) and found no correlation because average water temperature (14.8°C) occurred at high, medium, and low tide states. Air temperatures, lack of riparian area in upstream tributaries, and warm water discharge from Vancouver Lake (Figure 7) likely have greater influence on water temperature in Lake River than tide state, especially in the summer when water temperature in the Columbia River is similar to Lake River (Figure 6). Due to the significant urbanization, lack of riparian vegetation, and altered stream channels (including groundwater) throughout the watershed, the water temperature in Lake River is expected to exceed thresholds for rearing and migrating salmonids between June 1 and September 15. During this time period (Table 3), the occurrence of listed fish in the action area is likely limited to early migrating adult Chinook and coho, outmigrating juvenile Chinook and coho, and potentially some limited use by rearing coho juveniles when temperatures drop at night.

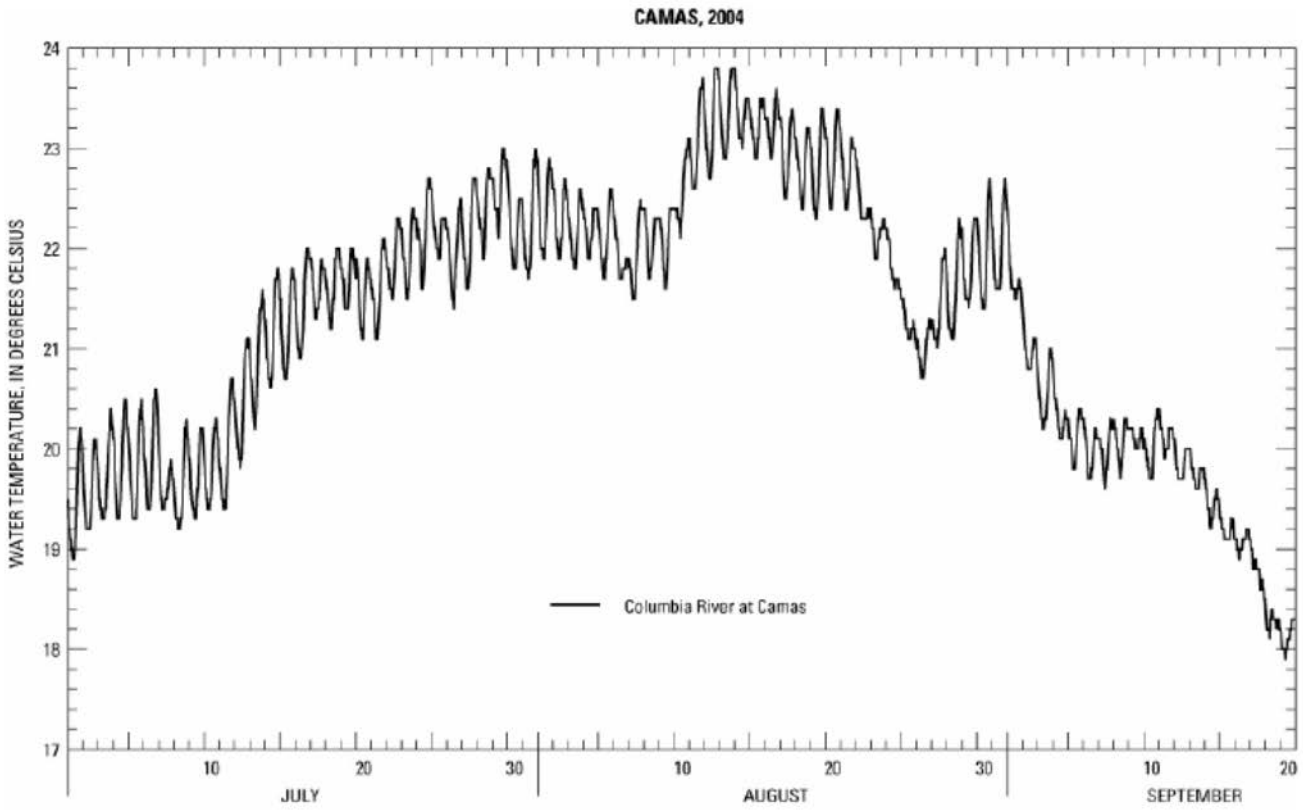

Figure 6 - Columbia River water temperatures near Camas, WA for summer 2004 (USGS 2004)

Water temperature also influences water chemistry, whereby the rate of reactions increases proportionate to temperature. The solubility of many toxic substances is increased and intensified as temperature rises, which can be noted in Lake River, where the outflow of toxic waters in Vancouver Lake flow into Lake River. Vancouver Lake is a shallow, stagnant, warm-water lake with excess nutrients due to the septic tank drainage from Salmon Creek that feeds into the lake, making it prone to algal blooms (Sudermann 2010). Algal blooms can impair water systems in various ways, and the most notable in Lake River is a decrease in dissolved oxygen (DO) caused by the stripping of oxygen by dying and decaying algae. In addition, increased temperatures diminish the solubility of dissolved oxygen,

while increasing the metabolism, respiration and oxygen demand of aquatic life. Therefore, oxygen levels are further depleted and cold water biota can become compromised as temperatures increase.

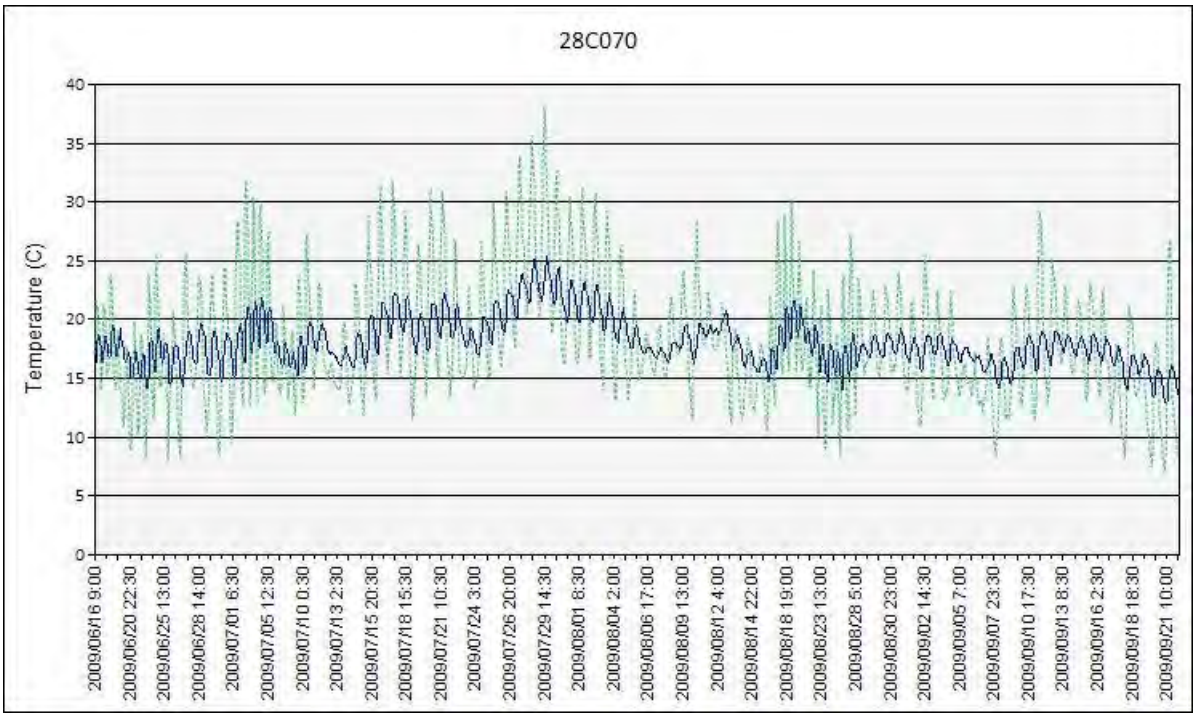

Figure 7 - Water temperature (blue) and air temperature (green) at the mouth of Burnt Bridge Creek, 2009

Chapter 4: Project Details

4.1 Construction

The major factors that influence how the new bridge will be built include site constraints from the adjacent railroad, the need to maintain public access over the old bridge during construction, and the USCG's requirement to maintain an opening for the navigation channel. The BNSF railroad on the eastern shore significantly limits construction access on that side of the river as trains pass frequently and BNSF require a setback for safe operation. All equipment and materials must pass over the railroad to reach the bridge site and delivery and placement of long bridge girders must be carefully planned to avoid prolonged blockage of the railroad. Therefore, it is likely that the most the equipment and materials will be stored at staging areas on the west side of the bridge. The existing bridge is the only access point to the River S Unit of the refuge and keeping the existing bridge open to traffic while constructing the new bridge would limit work space. There may be temporary closures but the old bridge is expected to be open to traffic most weekends during construction. Finally, the US Coast Guard requires that any temporary work bridge provide the same vertical and horizon clearance as the existing bridge for vessels to pass unimpeded.

4.1.1 Project Timeline and Sequencing

Construction is expected begin in the spring of 2016 and last up to two years (Table 6). All in-water work will occur as shown on Table 7. The first construction season will focus on erection of the temporary work bridges and installation of drilled shafts and completion of foundations and substructure. The second work season will involve demolition of the old bridge and removal of the temporary work bridge. As noted in Table 6 – Approximate construction schedule, there are timing restrictions related to work over the railroad and in-water impact pile driving. In-water work activities, other that impact pile driving, may occur year-round.

Table 6 – Approximate construction schedule

Schedule	Duration	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Timing restrictions													
No work over railroad	90 days												
In-water work window (impact pile driving)	47 days												
Tasks Year 1													
Award contract	1 day												
Mobilize	30 days												
Bridge shop drawings	45 days												
Bridge girder fabrication and delivery	190 days												
Design temporary work platforms	90 days												
Construct access roads and work platforms	20 days												
Construct west and east abutments	20 days												
Construct east approach MSE wall	45 days												
Construct west approach	45 days												
Construct in-water drilled shaft*	14 days												
Construct east bank drilled shaft	14 days												
Construct in-water piers and cap*	14 days												
Construct east bank piers and cap	14 days												
Set girder span 1	5 days												
Set girder span 2	5 days												
Tasks Year 2													
Set girder span 3 – over railroad	5 days												
Place and cure CIP deck	20 days												
Install bridge railing	10 days												
Demo existing bridge*	20 days												
Remove temporary work platforms*	20 days												

** in-water work*

Table 7 - Proposed timing of in-water work in Lake River

Activity	Description	Activity Duration	Timing
Install small-diameter piles (≤24”) with impact hammer with noise attenuation measures	Small-diameter piles will be used in the construction of temporary work bridges/platforms, tower cranes and oscillator support platforms.	Up to 1 hour/day (impact hammer operation). 14 days.	Only within approved in-water work window variance of June 1 through September 15.
Install small-diameter piles (≤24”) with non-impact methods(i.e., vibratory installation)	Small-diameter piles will be used in the construction of temporary work bridges/platforms, tower cranes and oscillator support platforms.	Length of work day is subject to local noise ordinances, however could be up to 24 hours/day. 2 years.	Year-round provided work does not violate water quality standards.
Extract small diameter piles (≤24”)	Removal of small-diameter piles will be done using vibratory equipment or direct pull.	Length of work day is subject to local noise ordinances, however could be up to 24 hours/day.	Year-round provided work does not violate water quality standards.
Install large-diameter drilled shaft casings (≥72”) using vibratory hammer, rotator, or oscillator to install casing	Used to construct the in-water piers and caps.	Length of work day is subject to local noise ordinances, however could be up to 24 hours/day. 28 days.	Year-round provided work does not violate water quality standards.
Clean out shafts and place reinforcing concrete inside steel casings.	Applies to all piers and shafts. All activities/materials will be contained within the casings and have no contact with the water.	Length of work day is subject to local noise ordinances, however could be up to 24 hours/day. 56 days.	Year-round provided work does not violate water quality standards.
Remove existing bridge timber piles, spot remove existing material from river bed.	Applies to all piles and cross-members. Removal by direct pull or use a vibratory hammer. If piles unable to be removed without breaking, cut off at the mudline. Piles not to be dug from the bed.	Length of work day is subject to local noise ordinances, however could be up to 24 hours/day. 2 years.	Year-round provided work does not violate water quality standards.

4.1.2 Site Preparation

Prior to ground disturbing activities, the contractor will install erosion control measures, such as sediment fence, as described the project’s SWPPP plan to prevent soil erosion into nearby waterbodies or ditches. Portions of the streambank south of the existing bridge will be cleared of vegetation to provide space for the temporary work bridge and new bridge. Most vegetation removal will occur along

the eastern streambank. About 20 deciduous trees, ranging in size from 6-20 inches in diameter, will be cleared from a 25- by 25-foot area (about 625 square feet). Trees will be cut at ground level with their rootballs left in place; no grubbing is planned. The cleared area would then be filled with cribbing and temporary fill to create a level interface between the work bridge and the ground. On the western streambank, an area about 40 feet by 24 feet (about 960 square feet) will be cleared of grasses and shrubs and filled with temporary fill to connect the work bridge to the existing ground. No fill or excavation in the river channel is needed for site preparation.

4.1.3 Construction Access and Staging

Construction will require areas for staging, preassembly, storage, and manufacture of materials. The following activities will be completed at on-site staging areas:

- Material storage including reinforcing, shaft casing, formwork, excavation waste, concrete materials, approach walls, and bridge rails
- Preassembly of reinforcing steel cages for drilled shafts

Based on these activities it is assumed that three areas near the bridge will be used for staging of equipment and materials: 1) City owned parcel near railroad tracks, 2) the field in the southwest quadrant in front of levee, and 3) behind the levee near public parking area. Additional space along the proposed roadway realignment could also be used depending on contractor operations and traffic control needs. The City owned parcel is currently surfaced with rock and being used as a staging area for railroad maintenance work. Staging in the field below the levee will allow for easy access to the work bridge. A nearby wetland in this area will be fence off during construction to prevent impacts. The staging area near the parking lot is likely where refueling and equipment maintenance will occur because it has the easiest access and is separated from the Lake River by a levee. The contractor will ultimately determine use and development of staging areas but these three locations appear to be the most feasible.

Although, FHWA expects most of the bridge work to be completed from the temporary work bridge, the contractor may elect to use a barge for certain tasks such as material delivery or removal of the old bridge. If needed, barge landings will be confined to areas of the shoreline already disturbed by other construction activities.

Access to staging areas and work site will primarily be from South Refuge Road with construction spur roads on each side of the river to connect to the temporary work bridge. A figure showing staging area is provided in Appendix A .

4.1.4 In-water Work

Temporary work bridge

A work bridge will extend into the river from each bank to allow drill rigs to position over the mid-channel drilled shaft locations and provide a location for cranes to place the girders. US Coast Guard has determined the Bridge Permit will be conditioned to require an open center span between the work bridge will be maintained to avoid impeding the navigation channel. The work bridge will be designed by

the contractor but it is likely to be supported on a grid of piles to create a work surface for construction of new bridge. The contractor will determine the final number and size of piles but the contract will stipulate that piles shall not exceed steel pipe pile 24-inches or steel H-pile greater than HP24. The work bridge is assumed to be about 24 feet wide and 380 feet long with approximately 60 foot by 40 foot work platforms at each pier; these structure dimensions are likely to require about 150 piles (assuming 6 foot spacing). For the purposes of this evaluation, it is assumed 108 of these piles would be located within Lake River below ordinary high water. To minimize disturbance to the river, the work bridge will be constructed using top down methods where steel piles are first place along the shoreline then topped with prefabricated bridge deck units before moving sequentially out into the river. Using this method, no equipment would operate in the water. Treated wood will not be used for any support piles or in any other part of the work bridge. Piles will be driven into the streambed using a vibratory hammer to the estimated tip then proofed with an impact hammer to load bearing capacity. The temporary work bridge would remain in place for approximately one year.

In-water bridge foundations

The construction of the bridge requires constructing two piers in the river. These piers will be situated to maintain the existing USCG navigation channel. Piers will be founded on large-diameter drilled shafts that will be sufficiently embedded within the soil for structure stability. For preliminary designs, the shafts are estimated to be 8-foot-diameter and 50-feet below ground line.

These shafts could be installed by using a track-mounted auger working from the temporary work bridge. Because the shafts are drilled below the water table and through outwash deposits and deep clay deposits, the holes are expected to require the use of a casing to prevent caving and maintain an open hole. The casings also function as a cofferdam that separates the drill site from the flowing water of Lake River. Water and soil removed from the river during foundation installation will pumped or contained and hauled to an upland disposal area or storage tank.

4.1.5 Bridge Work

The four-span precast girder system will be configured with four simple spans between each pier, and a continuous deck cast over the entire structure tying all the bridge elements together. Because of the inherent instability of single, unbraced girders, it is expected that the girders will be temporally braced until all subsequent girders place with internal diaphragms are installed. A concrete pumper truck located on the work bridge or shoreline will be used to deliver concrete to the new bridge deck. The bridge desk will be cast in watertight forms and any water used for concrete curing will be collected and disposed at an upland area. A containment system will be used to prevent debris from dropping into the river during over-water bridge work.

4.1.6 Road Work

The project involves only minor road work because the new bridge would tie into the existing road alignment. Since the new bridge will be slightly offset from the existing bridge the approach road will be shifted. Unused approach fill from the old road will be removed and the area re-contoured to match surrounding ground.

4.1.7 Removal of Existing Bridge

After the new bridge is complete the existing bridge will be removed. All utilities, railing and wood decking would be removed, and then deck stringers starting from one end working toward the other end would be removed. The creosote piles and steel pipe piles of the old bridge will be removed using use a vibratory hammer and crane. The vibratory hammer is useful in loosening the adhering sediments before extraction. Holes left by removed piles are expected to quickly fill in with sandy and silty substrates present at the bridge site. Capping of holes with imported sediments is not planned. Removal of the existing bridge is not subject to in-water work window restrictions, provided water quality standards are being met.

4.1.8 Post-project Site Restoration

The new bridge will be wider than the old bridge and removal of the approach fill associated with the old bridge will re-open a portion of the floodplain that was occupied by the old bridge. Disturbed areas will be reseeded and planted with native vegetation as prescribed by the refuge manager. USFWS will monitor the success of re-vegetation as part of their routine vegetation maintenance at the refuge.

The project will also conduct floodplain mitigation related to the FEMA requirements to maintain a no-rise scenario. Through the County Flood management department equivalent flood storage detention swale will be constructed. All fills into the floodway are on Refuge lands.

4.1.9 Avoidance and Minimization Measure

The project will implement impact minimization measures, including but limited to the following, to further avoid and minimize impacts associated with construction:

General conditions

- Install high-visibility construction fencing to avoid unintended impacts to sensitive areas. Implement an Engineer-approved Spill Prevention Control and Countermeasures (SPCC) plan to guard against the release of any harmful pollutant or product. Maintain a current copy of approved SPCC plan on-site for the duration of the project and no work or staging shall occur prior to implementing the plan. The approved SPCC plan provide site- and project-specific details identifying potential sources of pollutants (e.g. creosote treated timber), exposure pathways, spill response protocols, protocols for routine inspection fueling and maintenance of equipment, preventative and protective equipment and materials, and emergency notification and reporting protocols.
- Install and maintain appropriate temporary erosion and sediment control measures to avoid and minimize affects to waterbodies and wetlands resulting from clearing, grading, management of site drainage, and related activities.
- Clean and inspect all equipment to be used for the construction activities prior to arriving at the project site. Ensure no potentially hazardous materials are exposed, no leaks are present, and that equipment is properly functioning.

- All pumps used to collect water from Lake River will employ fish screening to avoid the impingement and entrainment of juvenile salmonids according to NMFS 2008.
- Implement a system or plan to ensure containment of materials, wastes, or debris resulting from bridge construction and demolition. Any treated wood wastes from old bridge will be disposed at a properly permitted disposal site.
- Avoid placement of tracks or equipment wheels in flowing water of Lake River when performing activities below OHWM. Operate construction equipment from work bridge, floating barge, or access road above OHWM.
- Use only vegetable-based oils in hydraulic lines for any equipment operating in the water.

Pile driving

- Impact hammer pile driving shall occur during an in-water work window of June 1 to September 15.
- Use of In-water vibratory piling for pile installation or removal may occur at any time.
- Place temporary piling for work bridge using a vibratory pile driver to drive pile to the point of practical refusal before switching to an impact hammer for pile proofing. This will reduce the number of pile strikes by upwards of 90 percent.
- All non-load bearing piles will be installed by vibratory means.
- When using impact hammer to proof piles surround the pile being driven with a bubble curtain, as described in NMFS and USFWS (2006, Appendix A),that must distribute small air bubbles around 100% of the pile perimeter for the full depth of the water column Prepare Water Quality Sampling Plan for conducting water quality monitoring according to the Washington 401 Water Quality Certification issued for the project.

Drilled shaft installation

- Use casing to installation to isolate the drilled shaft work area from the active flow of Lake River. Install casing using vibratory driver or casing oscillator.
- The casing will be placed to minimize fish entrapment and fish salvage will be conducting in the area surrounding the casing prior to installation according to WSDOT (2012) protocols (Appendix A).
- Pump waste water from drilled shaft installation to upland area or containment area for later disposal.

Piling removal

- Install a floating surface boom to capture floating surface debris, except in the Coast Guard defined navigation channel.

- Keep all equipment (e.g., bucket, steel cable, vibratory hammer) out of the water, grip piles above the waterline, and complete all work during low water and low current conditions.
- Dislodge the piling with a vibratory hammer, when possible – never intentionally break a pile by twisting or bending.
- Slowly lift the pile from the sediment and through the water column.
- Place the pile in a containment basin on a barge deck, pier, or shoreline without attempting to clean or remove any adhering sediment. Pilings shall not be shaken, pressure cleaned, left hanging to dry or any other action intended to clean or remove the adhering material from the pile.
- If pile is intractable or breaks, cut the pile off at the sediment line.
- Dispose of all removed piles, floating surface debris, any sediment spilled on work surfaces, and all containment supplies at a permitted upland disposal site.

Barge use

Any barge used as a work platform to support construction must be: (1) large enough to remain stable under foreseeable loads and adverse conditions; (2) inspected before arrival to ensure vessel and ballast are free of invasive species; and (3) secured, stabilized and maintained as necessary to ensure no loss of balance, stability, anchorage, or other condition that can result in release of a contaminant or construction debris.

Focus barge operations where water depths are the greatest and only move barges when water depths are sufficient to avoid and minimize prop-wash and resulting turbidity.

4.2 Operations

Although the new two-lane bridge will replace a single-lane bridge, the project will not increase capacity of within the project limits because the bridge only leads to the River S Unit of the refuge and there is no new development contingent or depended upon the project's completion. FHWA does not expect any discernible changes in the rate or pattern of land use conservation will result, in whole or in part, from the construction of the project.

The new bridge will create about 0.4 acres of new impervious surface. Most runoff (95 percent) from this new impervious surface will be diverted to the western side of the bridge and allowed to infiltrate into a vegetated area prior to reaching Lake River. A small fraction of runoff will flow to the east side of the bridge where it will infiltrate into vegetation. No direct discharge to the river will occur.

4.3 Maintenance

Once built, the maintenance requirements of the new bridge will be minimal and mainly involve periodic inspections. As a concrete bridge, regular painting is not required.

Chapter 5: Project Action Area

The action area encompasses all areas directly or indirectly affected by the proposed action. For this project, the action area includes the project footprint (i.e., limits of actual construction ground disturbance); all terrestrial areas within approximately 20,000 feet of the project that may be subject to construction noise; and the section of Lake River adjacent to and extending approximately 1,000 feet downstream of the project, accounting for potential suspended sediment inputs from in-water work area isolation establishment and removal. An explanation of how the action area was determined follows.

5.1 Project Footprint

The action area includes all areas directly affect by physical ground disturbance from construction activities. This includes all areas temporarily or permanently affected by site preparation, construction access and staging, in-water work, bridge construction, bridge demolition and removal, and site restoration. The combined action area with highlighted terrestrial and aquatic portions is shown in Figure 8.

5.2 Terrestrial Noise

Construction activities and noise from equipment that will cause point source noise greater than background conditions. The following equation was used to estimate the extent of construction-related noise:

$$\boldsymbol{D = D_o \cdot 10^{((construction\ noise - background\ sound\ level\ in\ dBA)/\alpha)}}$$

Where D = the distance from the noise source, Do = the reference measurement distance (50 feet in this case), and α = 25 for soft ground. This alpha (α) value assumes a 7.5 dBA reduction per doubling distance over soft ground.

Installation of the temporary work bridge will be the loudest operation because of the use of impact pile driver along with other equipment operating at the same time to place piles. The three loudest pieces of construction equipment associated with this action are impact pile driver (110 dBA), crane (81 dBA), and excavator (or second crane) (81 dBA). Noise levels from these three pieces of equipment were added together using the rules for decibel addition to estimate the combined noise level of all construction equipment operating together. As a result, greatest construction noise level was estimated at 110 dBA.

The background noise level was estimated at 45 dBA based on the estimated population density near the bridge (300 to 1,000 people per square mile according to 2010 census for Ridgefield; WSDOT 2014). Traffic noise on Refuge Road was not estimated because traffic is sparse (< 100 vehicles/hours) and slow moving (< 25 mph) and thus not a significant source of background noise. Plus, the nearest traffic data is for SR 501, which is not representative of the project site.

Using the equation above the maximum extent of project related noise will travel up to 19,905 feet (3.8 miles) from the construction site. This distance is largely theoretical as the equation used does not consider topography, vegetation, or atmospheric factors that can significantly affect attenuation rates of air-borne noise but these factors are difficult to predict and model.

5.3 Underwater Noise

Pile driving will temporarily increase underwater sound levels that will exceed background levels. Like terrestrial noise, the theoretical extent of project related underwater noise was estimated using the practical spreading loss calculation, shown above. Where D = the distance from the noise source, Do = the reference measurement distance (33 feet in this case), and $\alpha = 15$. This alpha (α) value assumes a 4.5 dB reduction per doubling distance.

The average single strike sound pressure level associated with 24-inch pipe pile (189 dB at 33 feet) was used to estimate the extent of underwater noise because this is the largest pile size that could be used for the temporary work bridge. The background sound level for Lake River was assumed to be 120 dB as Lake River has very little flow or turbulence and minimal boat traffic.

The theoretical distance to which pile driving noise (189 dB) would attenuate to background noise (120 dB) is over 247 miles. Obviously, underwater noise would intercept land before reaching this distance. Therefore, the action area related to underwater noise was defined as an area radiating from the bridge to the nearest shoreline since the bridge is located at a bend in the river.

5.4 Turbidity

The action area also includes a portion of Lake River upstream and downstream of the bridge that could be affected by increased suspended sediment and turbidity from construction activities. Depending on tidal condition, suspended sediment may disperse upstream or downstream from the bridge. The temporary turbidity mixing zone standards of the Washington Administrative Code (WAC 173-201A-400) were used to estimate the potential zone of sediment/turbidity impacts during construction.

As outlined in WAC 173-201A-400(7)(a), the maximum size for mixing zones in rivers and streams is 300 feet downstream and 100 feet upstream from the point of discharge. FHWA will implement a turbidity monitoring program to ensure that project related turbidity is near background conditions at a point 300 feet below in-water work activities.

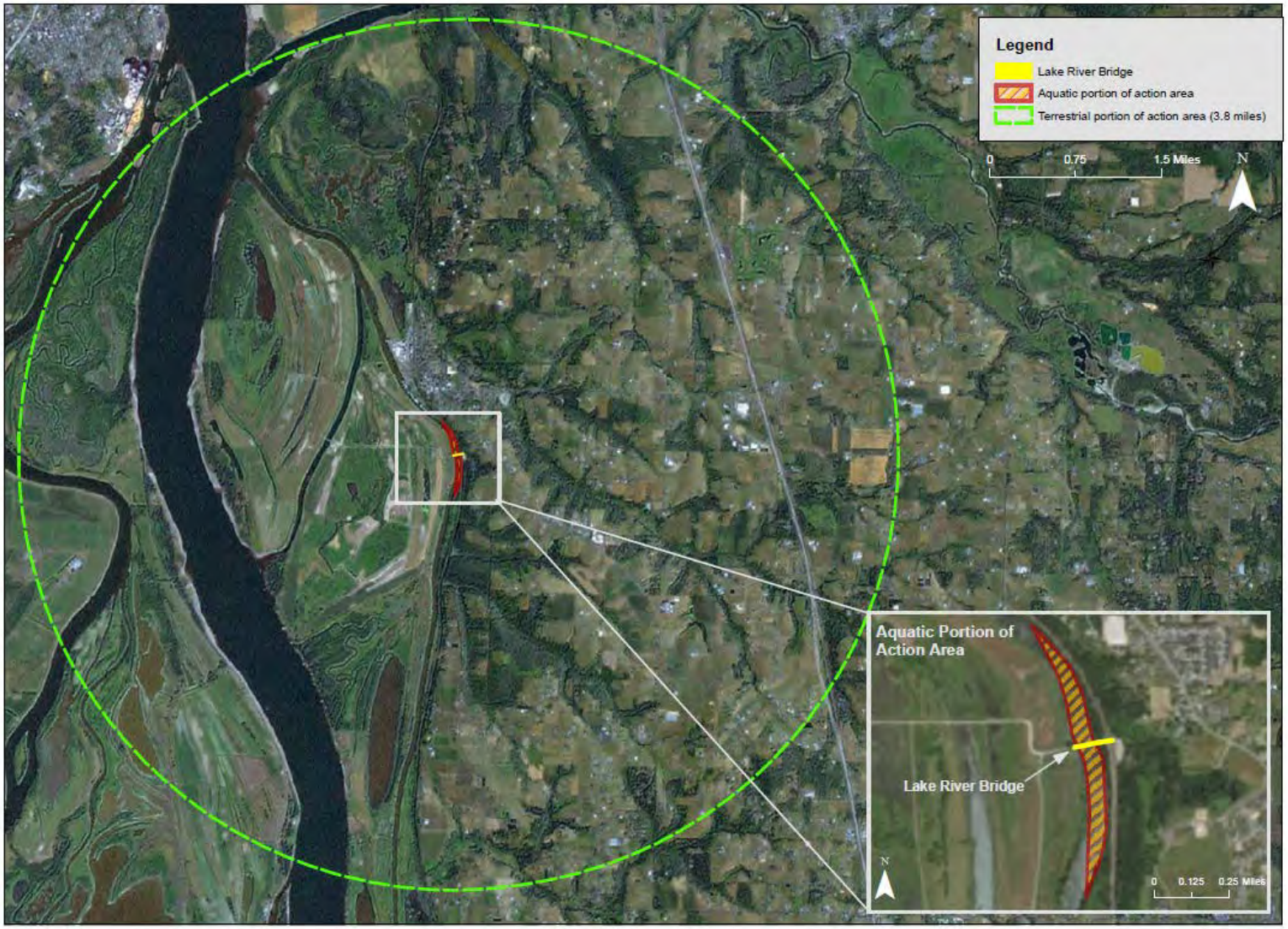

Figure 8 - Action area

Chapter 6: Effects Analysis

This section analyzes direct, indirect, and cumulative effects to listed species, habitat for listed species, and critical habitat for listed species. This section also analyzes the effects of interrelated and interdependent actions on listed species and critical habitat (USFWS and NMFS 1998). Direct effects include all immediate impacts that are caused by the project (such as construction and demolition) and that are directly related to actions that occur at or very close to the time of the project. Indirect effects are impacts that are caused by the project, but that occur later in time or are farther removed in distance from the project area and are still reasonably certain to occur. Cumulative effects are future state, tribal, local, and private activities that are reasonably certain to occur within the action area and are likely to affect the species considered in this BA. An interrelated action is one that is part of a larger action and depends on the larger action for its justification. An interdependent action is one that has no independent utility apart from the proposed action.

6.1 Direct Effects

6.1.1 Hydroacoustic Impacts

In-water pile driving is likely to create elevated noise levels in Lake River that could potentially cause disturbance or injury to listed fish. Fish present in these areas during impact pile driving could be exposed to sound pressure levels that could result in physical injury (particularly to air-filled spaces such as swim bladders), auditory tissue damage, temporary or permanent hearing loss, behavioral effects, and immediate or delayed mortality. The amount of energy and the resulting sound pressure from impact pile driving would vary depend on the size and type of pile, type of hammer, energy of the hammer, depth of the water column (i.e., tide state), and substrate. Impacts to individual fish also depend on the length of exposure since noise thresholds assume a stationary fish that is exposed to the elevated noise for the entire duration of the pile driving event.

Due to the prohibitively high temperatures exhibited in Lake River during the summer pile driving window (June 1 – September 15), it is likely that the majority of fish present during impact pile driving (Table 3) would be migratory fish that are likely to move past the bridge relatively quickly; minimizing their exposure to high noise levels. Plus, pile driving is a relatively short duration activity (Table 7) with pauses between installations of different piles, so migratory fish are not exposed to the full daily duration of pile driving noise.

Underwater noise thresholds for fish were developed by the Fisheries Hydroacoustic Work Group in 2008 and provide guidance on expected impacts on fish from elevated noise exposure. The current injury thresholds for fish are as follows:

- 206 decibel (dB) peak
- 187 dB cumulative sound exposure level (SEL) for fish > 2 grams
- 183 dB cumulative SEL for fish < 2 grams

Listed fish less than 2 grams are not likely to occur in the action area. Juvenile chum and larval eulachon larvae less than 2 grams occur in the Columbia River during the spring, but are not expected to occur in the action area during the in-water work period (or, in the case of chum, at any time). Fall Chinook, coho and steelhead juveniles, if present, would be larger than 2 grams as they migrate through the action area.

The size and type of pile will be selected by the contractor but could range up to 24-inch diameter piles. Pile size correlates to the sound level emitted when struck with an impact hammer (Table 7). If 24-inch diameters are used there is a potential that pile driving noise may reach the peak threshold value (206 dB), but this risk is diminished if small piles are used.

Table 8 – Sound pressure levels at 10 meters associated with impact pile driving of various pile sizes (WSDOT 2014)

Pile type	Sound level (single strike)		
	Peak	RMS[1]	SEL[2]
Steel H-pile	190 dB	175 dB	155 dB
12-inch steel pile	207 dB	189 dB	173 dB
14-inch steel pile	198 dB at 22m	182 dB at 22m	170 dB @ 22m
16-inch steel pile	200 dB at 9m	187 dB at 9m	n/a
24-inch steel pile	212 dB	189 dB	181 dB

[1]Root mean squared; [2] Sound exposure level

Other that peak values, the noise threshold values account for accumulated exposure to elevated sounds levels with every hammer strike over a 12 hour period (i.e. a construction work day). For this project, the use of impact pile drivers will be minimized by first using vibratory drivers to insert most of the pile depth (within 5 feet of anticipated final tip depth) and then finally proofing them to load bearing capacity by impact hammer. Use of vibratory pile driving will reduce the total number of impact hammer strikes needed by 90% as only a few strikes are needed to proof each pile. The number of strikes to proof each pile will vary depending on site conditions but is assumed to be 25 strikes per pile. The production rate of pile installation will vary depending on contractor operations but is assumed to be 15 piles per day. Therefore, approximately 375 strikes per day will occur using these conservative assumptions. Using these values, the distance to the injury threshold (187 dB SEL) for fish <2 gram was estimated for the various pile sizes listed in Table 7 were estimated with the NMFS Calculator (Table 9).

In-water noise attenuation measures will be employed during impact pile driving to lessen the extent of elevated sound levels and potential for fish injury. FHWA assumes that an unconfined bubble curtain will be deployed around each pile struck with an impact hammer; although, the contractor may selected an alternative noise attenuation measures with FHWA approval. For this project, FWHA assumes that 11 dB will be achievable by using an unconfined bubble curtain during impact pile driving. This attenuation factor was based on WSDOT's (2013) synthesizes of noise monitoring data from several pile driving

projects in Washington that found unconfined bubble curtains have an average sound attenuation of 11.9 dB with standard deviation of 8.7 dB. The effectiveness of bubble curtains varies with site conditions, and WSDOT (2013) notes there can be "significant variation in noise reduction achieved from different attenuation devices and at different location." But the attenuation factor assumed for this project is similar to the average attenuation measured at other WSDOT projects (Friday Harbor – 2dB; Cape Disappointment – 11 dB; SR 520 – 20 dB) that drove piles (24 inches in diameter or less) into relatively soft substrate comparable to Lake River.

Table 9 – Output from NMFS calculator for various pile sizes

	Distance (m) to peak dB threshold (206 dB)		Distance (m) to cumulative SEL dB threshold for fish >2 g (187dB)	
Pile type	With bubble curtain	With bubble curtain	Without bubble curtain	With bubble curtain
Steel H-pile	1	0	4	2
12-inch steel pile	12	2	61	37
14-inch steel pile	6	1	84	51
16-inch steel pile	4	1	n/a	n/a
24-inch steel pile	25	4	207	127

Within the zones of insonification listed in Table 9 fish would be exposed to sound levels that could cause physical injury. Pile driving may cause fish to temporary avoid the action, impede or discourage free movement the action area, prevent individuals from exploiting preferred habitat or expose individuals to less favorable conditions. Actual exposure to noise above injury thresholds and disturbance guidance will be limited, restricted to periods when impact pile driving is occurring, June 1 – September 15. Less than 28 days total over that duration. Within this time period, exposure will be further restricted to no more than 1 hour cumulative per 12-hour workday, and like the aquatic portion of the action area, the size of these zones will be limited by intervening land. During the proposed in-water work period for impact pile driving of June 1 – September 15, juvenile salmon are expected to have completed out migrating through the action area downstream to the Columbia River. Because water temperature in Lake River is expected to be greater than 18°C during the summer (see Chapter 3), the presence of rearing juvenile fish, though possible, is unlikely during the summer impact pile driving window.

Vibratory pile driving will be used to install temporary piles for the project. Load-bearing piles will be vibrated into place before being proofed with an impact hammer. Piles that are not load bearing (mooring piles) will be installed using vibratory means only.

Vibratory pile driving produces lower peak noise levels than impact pile driving of the same sized pile, and this generally results in fewer injuries to fish (Carlson, et al 2001). Currently there are no established thresholds for noise levels generated by vibratory pile driving that are likely to cause injury or behavioral disturbance to fish. Additionally, there are no established threshold distances at which vibratory noise is likely to harm fish. NMFS offers guidance that vibratory pile driving noise at 150 dB RMS may cause behavioral disturbance to fish. Vibratory pile driving on the project is likely to create noise above 150 dB RMS. All of the species and life stages of salmon, steelhead and eulachon shown in Table 2 could be exposed to this effect when they are present in this portion of the action area. However, because fish kills attributed to the use of a vibratory hammer have never been documented, this activity is unlikely to injure fish and is not expected to significantly interfere with behaviors such as migration, rearing or foraging. Thus, vibratory pile driving at any time of the year is not likely to adversely affect any of these species.

6.1.2 Temporary Effects to Water Quality

Activities associated with bridge construction will result in direct soil and sediment disturbance, and vegetation removal in the riparian area of Lake River. These activities could cause temporary, localized turbidity that could reach levels that adversely affect fish. However, upland sources of erosion, such as construction access roads, will be contained using erosion control and sediment detention measures described in the project's Erosion Control Plan. Erosion control measures will be frequently inspected as to maintain a continuous barrier between ground disturbing activities and Lake River or ditches. With these measures in place, this is only a discountable risk that upland activities could generate turbidity in Lake River.

In-water activities could generate localized and short duration turbidity events associated with disturbance of the streambed (Table 10). Proposed in-water activities do not involve in-water excavation and disturbed relatively small amounts of the stream bed, and are expected to cause only minor effects.

Table 10 - Potential sources of turbidity

Activity	Timing	Likely extent of downstream turbidity	Duration of effect (hrs/day)	Number of workdays
Installation of temporary piles by vibratory hammer	Year 1	~25 feet	6 – 8 hrs	~ 20 days (100 piles, 5 piles installed per day)
Installation steel casing to drill permanent shafts	Year 1	~25 feet	8 – 10 hrs	~ 4 days (4 casings, one installed per day)
Use of barge	Year 1 & 2	<300 feet	Varies	Up to 50 days per season
Demolish existing bridge, including pile removal	Year 2	Minimal	8 – 10 hrs	~15 days
Remove temporary piles	Year 2	Minimal	8 – 10 hrs	~10 days (100 piles, 10 removed per day)

Turbidity monitoring during the test pile project for the Columbia River Crossing project found no discernible difference in turbidity between ambient conditions and periods of pile driving a 24 inch diameter piles (DEA 2011). WSDOT observed similar findings of no increase in turbidity during pile driving at two bridge construction project at the Yakima River (WSDOT 2004, 2005). Given these past examples, the stirring of sediments and the resultant turbidity during pile driving is expected to be minor. Plus, the low flow velocity and coarse sand substrate of Lake River is expected to keep turbidity events localized (within 25 feet) of active work.

Piling removal may have a greater potential for causing increase suspended sediments than pile installation. The Jamestown S'Klallam Tribe (2006) found that the removal of relic wood piles from the mouth of Jimmycomelately Creek near Lower Sequim Bay, WA caused an increase in total suspended solids of approximately 40 mg/L above background near the pile and 26 mg/L about 5 to 10 meters from the pile. They reported that the turbidity plume appeared finite but were unable to measure the duration of elevated turbidity due to prop wash from the tug boat used to extract piles.

Although the duration and risk of exposure to project related turbidity is small, fish may still encounter unfavorable habitat conditions caused by in-water work. Pulses of increased suspended sediment can affect fish behavior by displacing fish as they seek new habitat with clearer water. This behavior change induces physiological stress, reduces feeding success, and diminishes the ability to detect and avoid predators. Suspended sediment can also physically harm fish's gills. The deposition of sediment can reduce the quality of substrates for spawning and bury aquatic macro-invertebrates and other fish food source.

The effect of suspended sediment on fish is a function of concentration and exposure duration (Newcombe and Jensen 1996). Low concentrations of suspended sediment over short periods may result in relatively negligible behavior effects on fish, such as alarm reaction to a sediment plume or abandonment of cover to seek refuge from the suspended sediment. Moderate or heavy concentrations of suspended sediment can have sublethal to lethal effects depending on exposure duration. For example, Goldes (1983, as cited in Newcombe and Jensen 1996) reported gill damage in rainbow trout

exposed to high suspended sediment concentration (4,887 mg/l) over a moderate time frame (16 days). Likewise, Sigler et al. (1994) found that growth rates in steelhead were significantly reduced when exposed to a comparatively moderate suspended sediment concentration (102 mg/l) over a long period (1 year).

Proposed in-water for this project is expected to cause a short term release (i.e., pulse) of suspended sediment at low concentrations that could cause some level of behavior response or minor sublethal effect during turbidity events (Table 10). Turbidity is not expected to extend across the entire river and there will be unaffected areas nearby that fish can access as “turbidity refugia” (Bash et al. 2001). Although displacement or change in behavior may occur, no fish mortality is expected from project related turbidity or suspended sediment.

6.1.3 Creosote Exposure

Creosote is a fungicide, insecticide, and sporicide used as a wood preservative for commercial purposes and specifically for bridge and pier pilings, utility poles, and railroad ties. This pesticide is derived from a high temperature distillation of coal tar, is a mixture of hundreds of organic compounds, and is known to be toxic. The primary chemical of concern is polycyclic aromatic hydrocarbons (PAHs) that may leach into the substrate surrounding each pile. Removal of these piles has the potential to adversely affect fish species present within the project area through increased suspended sediment and exposure to toxic pesticides. However, fish are at lower risk than mollusks and benthic organisms, since fish have some ability to metabolize and excrete PAHs. Removing these treated piles will improve the surrounding aquatic environment over the long term through removal of contaminated sediment.

The primary effect of removing piles is the suspension of sediments, which may result in harmful levels of turbidity and release of contaminants if contained in disturbed sediment. This sediment may also hamper adult respiratory function, potentially stalling migrating salmon in the mouths of rivers or streams while waiting for water to clear. Increased turbidity may also hinder juvenile foraging ability or affect the distribution of prey species. Conducting work during low water may help to reduce some of the sediment impacts to the project area; however, Lake River does not have a lot of flow, and so the likelihood of suspended sediments being carried away from the pile removal area is low.

Hydrocarbons leach from treated piles into the surrounding aquatic environment, soils, and benthic organisms during the life of the pile, potentially having adverse effects to fish and benthic invertebrates. Soils in direct contact with the piles are most likely to have larger concentrations of creosote, so removed piles will be directly placed in a containment area (work bridge or barge deck) without any attempt to clean debris attached to the pile. Impacts from broken piles will likely be minimal, as floating debris will be collected inside the float containment boom and collected for disposal.

6.1.4 Drill Shaft Dewatering and Fish Salvage

All fish passing through the work area during isolation and dewatering (estimate duration of each round of dewatering and salvage), might be subject to harassment and associated take due to fish salvage. Drilled shaft installation may occur at any point during the year, thus adult and juvenile fish may be present during this activity. Adult fish are assumed to mobile enough to avoid entrainment in the

casings. Fish salvage would be conducted by experienced biologists in accordance with WSDOT fish exclusion protocols. These protocols should minimize potential for lethal take of juveniles, and impact minimization measures described in Section 4 should reduce the potential for detrimental effects to listed fish. Potential direct effects to individual fish, if salvaged, include displacement or disturbance, temporary habitat alteration, potential injury or mortality, and exposure to sediment, petroleum products and uncured concrete.

6.1.5 Hazardous Material and Chemical Spills

Use and storage of hazardous materials and chemicals (e.g., diesel fuel, lubricants, uncured concrete) near waterways could potentially impair water quality if chemicals or other construction materials are spilled or enter waterways. In general, construction-related chemical spills could affect fish by increasing physiological stress, reducing biodiversity, altering primary and secondary production, and possibly causing direct mortality. Therefore, the impact assessment qualitatively evaluates the potential for hazardous materials and chemical spills to alter aquatic habitat conditions in the Lake River.

The only potential sources of contaminants in the project would be construction equipment (lubricating oils and fuel). The worst-case scenario for a hazardous materials release from construction equipment would likely be 100 gallons (estimated maximum size of fuel tanks, hydraulic fluid reservoirs, etc.). These substances can kill aquatic organisms through exposure to lethal concentrations or exposure to non-lethal levels that cause physiological stress and increased susceptibility to other sources of mortality such as predation. Petroleum products also tend to form oily films on the water surface that can reduce dissolved oxygen levels available to aquatic organisms. Adverse effects related to contaminant spills and leaks could result, but will be adequately mitigated by implementing an SWPPP as part of the environmental commitments for the project. With BMPs in place, the potential for adverse effects from hazardous materials is anticipated to be minimal.

6.1.6 Avian Predation

Overwater structures associated with the temporary work bridge or the permanent bridge could attract piscivorous birds and provide them with an artificial perch, which could increase predation of juvenile salmons migrating through the action area. While avian predation has been noted as a limiting factor near mainstem dams (near juvenile bypass facilities in particular) and dredged spoils islands, the likelihood of this project changing the foraging behavior of predaceous birds is low. First, there are no indications that birds perch on the existing bridge. Second, the water clarity of Lake River is poor which decrease foraging success for birds. Finally, the bird species most associated with avian predation of juvenile salmon – Caspian terns, double-crested cormorants, and gulls – rely on open habitat of dredge spoil islands and this habitat type is not found near the project area. Therefore, the potential risk for increased avian predation due to the proposed action is discountable.

6.2 Indirect Effects

Indirect effects are those effects that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur.

6.2.1 Altered Predator-Prey Relationships

Potential loss of some salmonid prey items due to siltation and substrate disturbance may occur during bridge construction and pile removal. However, there will likely be minimal to no effects on predator-prey relationships for rearing anadromous fish after construction is complete. Short-term impacts due to increased siltation would likely diminish over time and not cause any long-term changes to foraging behavior or prey availability.

6.2.2 Long-Term Habitat Alteration

Fish may experience temporary loss of cover due to disturbance of riparian vegetation bridge construction occurs. Loss of riparian vegetation may make juvenile salmon more susceptible to predation, as their source of cover has been removed. Removal of riparian vegetation in the project area could also reduce foraging habitat for juveniles, which could lead to increased competition in unaffected areas. These riparian areas would be restored following construction completion, thus these would be temporary impacts.

Replacing the old bridge will be advantageous to the environment since the new bridge will have less in-water elements, built with two piers versus many creosote-treated timber piles. Removing these piles will have a long-term benefit to Lake River by reducing the amount of toxic hydrocarbons leaching from the piles into the surrounding water and soils. The new bridge will also have a wider opening and span more floodplain, minimizing confinement of the stretch of Lake River that runs underneath the bridge, and allowing for more natural flow.

6.2.3 Indirect Land Use Impacts

The project will replace the old single land bridge with a new two lane bridge spanning Lake River at the existing location. There would be no changes to the size or shape of the adjoining roads on either side of the bridge in order to accommodate the new bridge. Although the project would improve the roadway at bridge, there is no additional development needed, so no land use changes will occur.

6.3 Interrelated and Interdependent Actions

The project will enhance floodplain storage as part of the land use requirement through Clark County for ‘balance cut and fill’ in the floodplain. This action could have a minor benefit to fish. Additionally, in the project area, derelict piles and historical debris will be removed from Lake River and would also have a minor benefit to fish.

6.4 Cumulative Effects

In the 2013 Biological Opinion for the translocation of Columbia white tailed deer to the refuge, USFWS stated “there are no known specific future non-federal activities within the action area that would cause significantly greater impacts on [Columbia white tailed deer] than presently occur.” While the actions are different between translocating deer and building a bridge, the projects share a similar action area.

Most of the land in the action area is owned by USFWS and future non-federal actions on this land are not expected. There may be other non-federal development on private lands in the action area, such as house construction, utility upgrades, or road construction, that could cause water quality degradation in Lake River. The increase of impervious surfaces could lead to more erosive flow in tributary streams that could degrade water quality in the action area. Generally, cumulative effects are expected to have adverse impacts on listed species in the action area.

Chapter 7: Effect Determinations

Based on the project effects presented in Chapter 6: FHWA made effect determination for each species that may occur in the action area (Figure 8). Effect determinations take into account all of the possible project effects.

Table 11 – Effect determination for listed species

Species	Status	Effect Determination for Species	Effect Determination for Critical Habitat
Lower Columbia River Coho Salmon	Threatened	LAA	Will not destroy or adversely modify (NLAA provisional determination)
Lower Columbia River Chinook Salmon	Threatened	LAA	NLAA
Columbia River Chum Salmon	Threatened	NLAA	NLAA
Lower Columbia River Steelhead Trout	Threatened	LAA	NLAA
Eulachon	Threatened	NLAA	NE

LAA = likely to adversely affect; NLAA = not likely to adversely affect; NE = no effect

7.1 Lower Columbia River Coho, Chinook, and Steelhead

The project **may affect** LCR coho, LCR Chinook, and LCR steelhead because:

- Suitable rearing habitat is present in Salmon Creek upstream of the project and fish must migrate through the action area.
- Juvenile salmon and steelhead may occur in low numbers in Lake River during construction.
- The in-stream pile driving window (June 1 – September 15) overlaps with juvenile coho/Chinook outmigration timing, and the latter portions of adult migration timing for early-returning adult coho and Chinook.
- The project will conduct in-water and over-water work that generates underwater noise and turbidity above ambient levels.
- The project will remove small areas of riparian vegetation.

The project is **likely to adversely affect** these ESUs/DPSs based on the following:

- Underwater noise during impact pile driving may exceed thresholds for behavior disturbance and onset of injury. If fish are present during the June 1 – September 15 pile driving window, impact pile driving-related sound exposure may cause delayed migration, tissue damage, or mortality for fish.
- Installation of the new bridge foundations and removal of old bridge may temporarily increase turbidity over baseline conditions, potentially resulting in injury or behavioral harassment.
- Fish may become entrained in casing for drilled shafts, where they will likely perish.
- Direct handling of fish during salvage poses the risk of injury or mortality.

7.2 Columbia River Chum

The project **may affect** Columbia River chum because:

- Columbia River chum historically occurred in the Salmon Creek Basin and Lake River was used a migratory corridor. But currently, Salmon Creek Basin does not support a self-sustaining population of chum. Prospects for restoration of significant chum habitat are limited in this urbanized subbasin.
- The likelihood of chum occurrence in Lake River during construction is remote.

The project is **not likely to adversely affect** this ESU because:

- In-stream pile driving would not overlap with periods when Columbia River chum life history stages are typically present in lower Columbia River tributaries.
- The potential occurrence of CR chum in the action area during impact pile driving work is so remote as to be discountable. There are no current records of spawning by chum salmon in the Salmon Creek and spawning habitat is not present in the Lake River action area. Instream temperatures in the summer, when impact pile driving would occur, exceed beneficial use standards for migration and rearing and likely preclude rearing by any juvenile salmonids.
- Chum will seek out hyporheic flow (upwelling) or riffle habitat to spawn. This habitat type is not present in Lake River. Substrate in the action area is primarily fine sand and silt which is not suitable for chum spawning
- Chum fry spend very little time in fresh water (<10 days), and begin their migration soon after emerging drifting downstream with the current. Any rearing by outmigrating fry would be at the confluence of Lake River and the Columbia River and well outside the aquatic action area.
- Seasonally suitable rearing habitat is not present in the aquatic action area.

7.3 Eulachon

The project **may affect** the Southern DPS of eulachon because:

- Eulachon are known to congregate in the Lewis River downstream of the action area; however, Lake River offers no suitable habitat for eulachon and their presence in the action area is unlikely.

The project is **not likely to adversely affect** based on the following:

- Lake River is generally too warm most of the year to support eulachon spawning.
- Substrates in the action area are fine sand and silt, not coarse sand eulachon require for spawning.
- Eulachon's freshwater spawning and larvae outmigration phase (December to May) does not coincide with in-water impact pile driving (June 1 – September 31).

7.4 Critical Habitat

7.4.1 LCR Chinook, LCR Steelhead and CR Chum

The project **may affect** designated critical habitat for LCR Chinook, LCR steelhead, and Columbia River chum because:

- Lake River is designated as critical habitat within the action area and serves as migration corridor linking to spawning and rearing habitat in Salmon Creek and Burnt Bridge Creek.
- The project may cause temporary turbidity above baseline conditions during in-water work.
- The project will remove riparian vegetation and re-vegetate disturbed riparian areas along Lake River.

The project is **not likely to adversely affect** critical habitat for these species based on:

- Underwater noise levels may exceed thresholds for behavior disturbance and injury to fish, which may temporarily degrade the mitigation PCE for no more than 12 hours per day during impact pile driving. Plus, noise attenuation devices will be used to minimize the extent of harmful noise.
- In-water work may temporarily increase turbidity above baseline levels that could cause short term degradation of the migration PCE for a period no more than 12 hours per day during operations that disturb sediment. But short duration impacts to water quality will be off set by the removal of creosote treated piles from Lake River, which are a chronic source of water pollution. This is a beneficial effect.
- New bridge foundations will cause a permanent physical loss of habitat but this area will be off set by removing the old bridge. The new bridge will be wider and allow Lake River to have greater connection with its floodplain than the current bridge.

7.4.2 LCR Coho

As discussed in Section 2.1.3, critical habitat for LCR coho salmon was proposed on January 14, 2013 but has yet to be finalized. Lake River is included in the proposed designation. Therefore, the project **will not destroy or adversely modify** proposed LCR coho critical habitat because:

- Anticipated habitat impacts within this proposed critical habitat area will not permanently affect suitable rearing habitat and the migratory corridor will remain unimpeded. Due to the presence of silty substrates and lack of spawning gravels, the freshwater spawning PCE is not present in the action area.
- The conservation role of the habitat for the species will not be altered by the proposed project.
- If LCR coho critical habitat is designated in the action area (i.e., Lake River) prior to completion of this project, a provisional effect determination for critical habitat is may affect, not likely to adversely affect for the same rationale as presented above for LCR Chinook, steelhead and CR chum.

7.4.3 Eulachon

The project will have **no effect** on designated eulachon critical habitat as it is not present in the action area.

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Appendix A: Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) includes a mandate that NOAA Fisheries must identify essential fish habitat (EFH) for federally managed marine fishes, and federal agencies must consult with NOAA Fisheries on all activities or proposed activities authorized, funded, or undertaken by the agency that may adversely affect EFH. The Pacific Fisheries Management Council (PFMC) has designated EFH for the Pacific salmon fishery, federally managed ground fishes, and coastal pelagic fisheries (NOAA Fisheries 1999; PFMC 1999).

The EFH designation for the Pacific salmon fishery includes all those streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Washington, Oregon, Idaho, and California, except above the impassible barriers identified by PFMC (1999). In estuarine and marine areas, proposed designated EFH for salmon extends from near-shore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone offshore of Washington, Oregon, and California north of Point Conception (PFMC 1999).

The Pacific salmon management unit includes Chinook (Oncorhynchus tshawytscha), coho (Oncorhynchus kisutch), and pink salmon (Oncorhynchus gorbuscha). All three of these species use Hood Canal for adult migration, juvenile out-migration, and rearing where suitable habitat is present. Coho and Chinook are known to stage in Hood Canal as subadults.

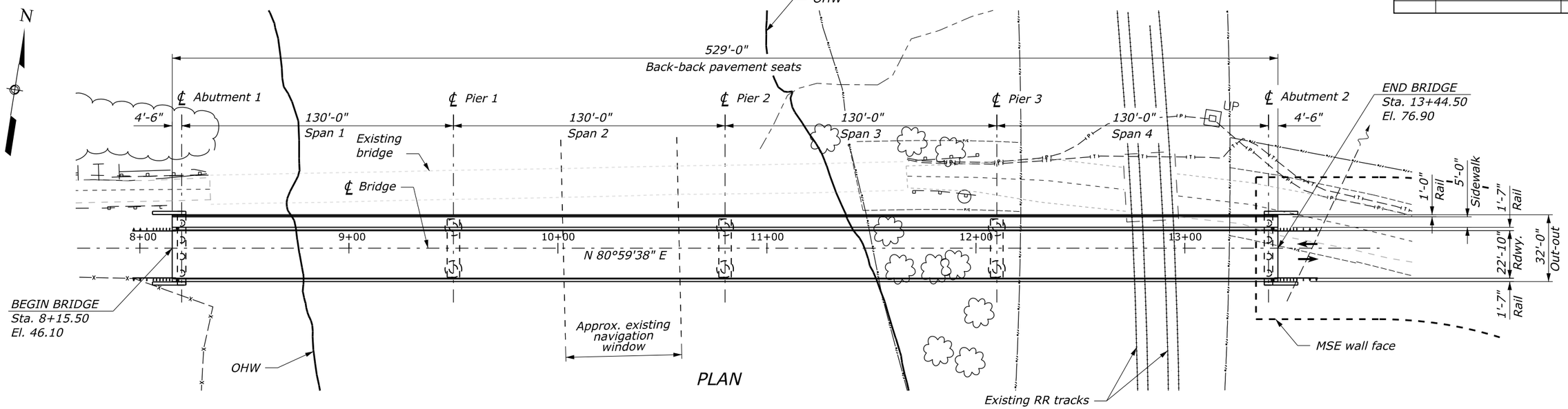
The EFH designation for ground fishes and coastal pelagics is defined as those waters and substrate necessary to ensure the production needed to support a long-term sustainable fishery. The marine extent of ground fish and coastal pelagic EFH includes those waters from the near-shore and tidal submerged environment within Washington, Oregon, and California state territorial waters out to the exclusive economic zone (370.4 km [231.5 miles]) offshore between Canada and the Mexican border.

The west coast ground fish management unit includes 83 species that typically live on or near the bottom of the ocean. Species groups include skates and sharks, rockfishes (55 species), flatfishes (12 species) and ground fishes. Ground fishes such as lingcod (Ophiodon elongates), Cabezon (Scorpaenichthys marmoratus), and brown rockfish (Sebastes auriculatus) potentially occur in Hood Canal (NOAA Fisheries 1998). Coastal pelagics are schooling fishes, not associated with the ocean bottom, that migrate in coastal waters. West coast pelagics include the pacific sardine (Sardinops sagax), Pacific chub (Scomber japonicus), northern anchovy (Engraulis mordax), jack mackerel (Trachurus symmetricus), and market squid (Loligo opalescens). These fishes are primarily associated with the open ocean and coastal areas (PFMC 1998) and are not likely to occur in the project area.

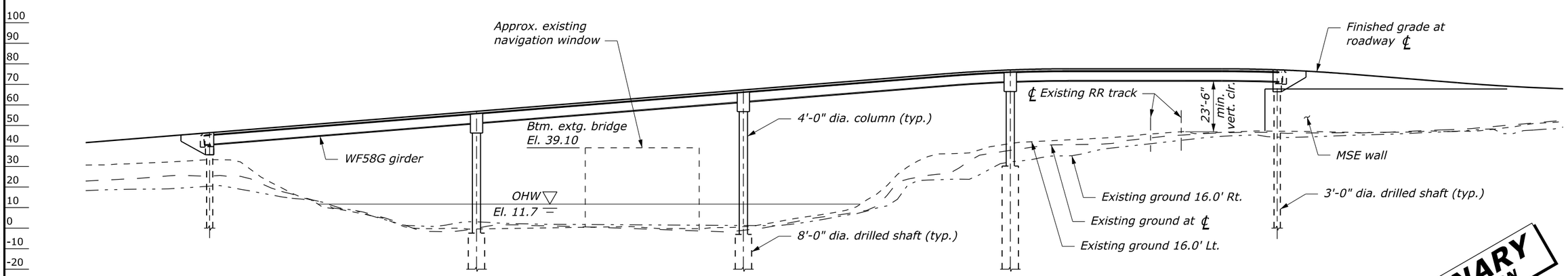
Essential fish habitat Pacific salmon is present in the project action area. The project will result in a minor, temporary effect on water quality. No permanent adverse effects on EFH for ground fishes, coastal pelagics, Pacific salmonids, or their prey species will result from the proposed action, as described in Chapter 4: of this Biological Assessment. Therefore, the project will not adversely affect EFH for ground fishes, coastal pelagics, or Pacific salmonids.

Appendix B: Project Drawings

STATE	PROJECT	SHEET NUMBER



PLAN



ELEVATION

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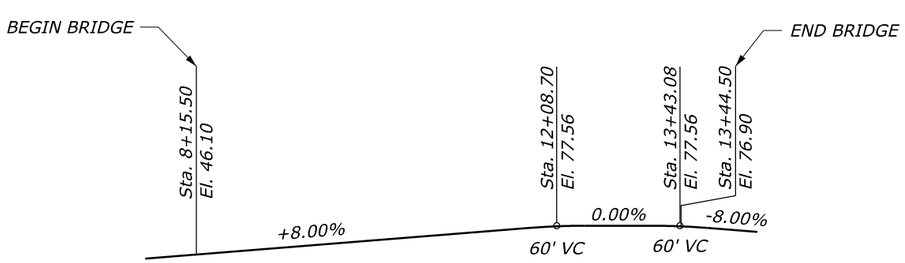
NOT FOR CONSTRUCTION



PROFILE GRADE DIAGRAM
NTS

HYDRAULIC DATA			
	Q ft³/sec	V ft/sec	WS Elev.
Q_2	-	-	-
Q_{50}	-	-	-
Q_{100}	-	-	-
Q	-	-	-

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
WESTERN FEDERAL LANDS HIGHWAY DIVISION

LAKE RIVER BRIDGE

RIVER 'S' UNIT
RIDGEFIELD NATIONAL WILDLIFE REFUGE

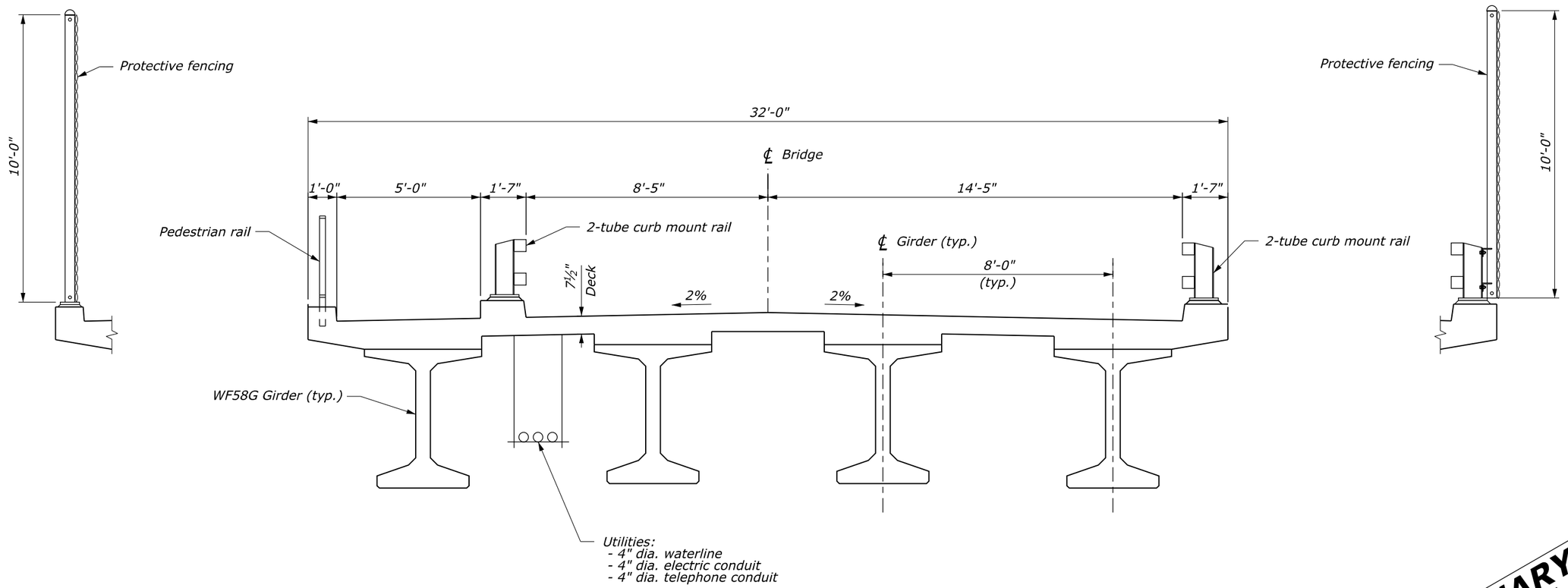
CLARK COUNTY, WASHINGTON

PLAN AND ELEVATION

NO.	DATE	BY	REVISIONS	NO.	DATE	BY	REVISIONS	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	PROJECT TEAM LEADER	BRIDGE DRAWING	DATE	DRAWING NO.
									H. GONSIOR		1" = 50'		1 of 37		BR01

...\BR01_PlanElevation.dgn [US_Sur2D] 21-Jul-2014 01:05 PM

STATE	PROJECT	SHEET NUMBER



TYPICAL SECTION

PRELIMINARY
NOT FOR CONSTRUCTION

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
WESTERN FEDERAL LANDS HIGHWAY DIVISION

LAKE RIVER BRIDGE

RIVER 'S' UNIT
RIDGEFIELD NATIONAL WILDLIFE REFUGE

CLARK COUNTY, WASHINGTON

TYPICAL SECTION

NO.	DATE	BY	REVISIONS	NO.	DATE	BY	REVISIONS	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	PROJECT TEAM LEADER	BRIDGE DRAWING	DATE	DRAWING NO.
									H. GONSIOR		1/4" = 1'-0"		21 of 37		BR21

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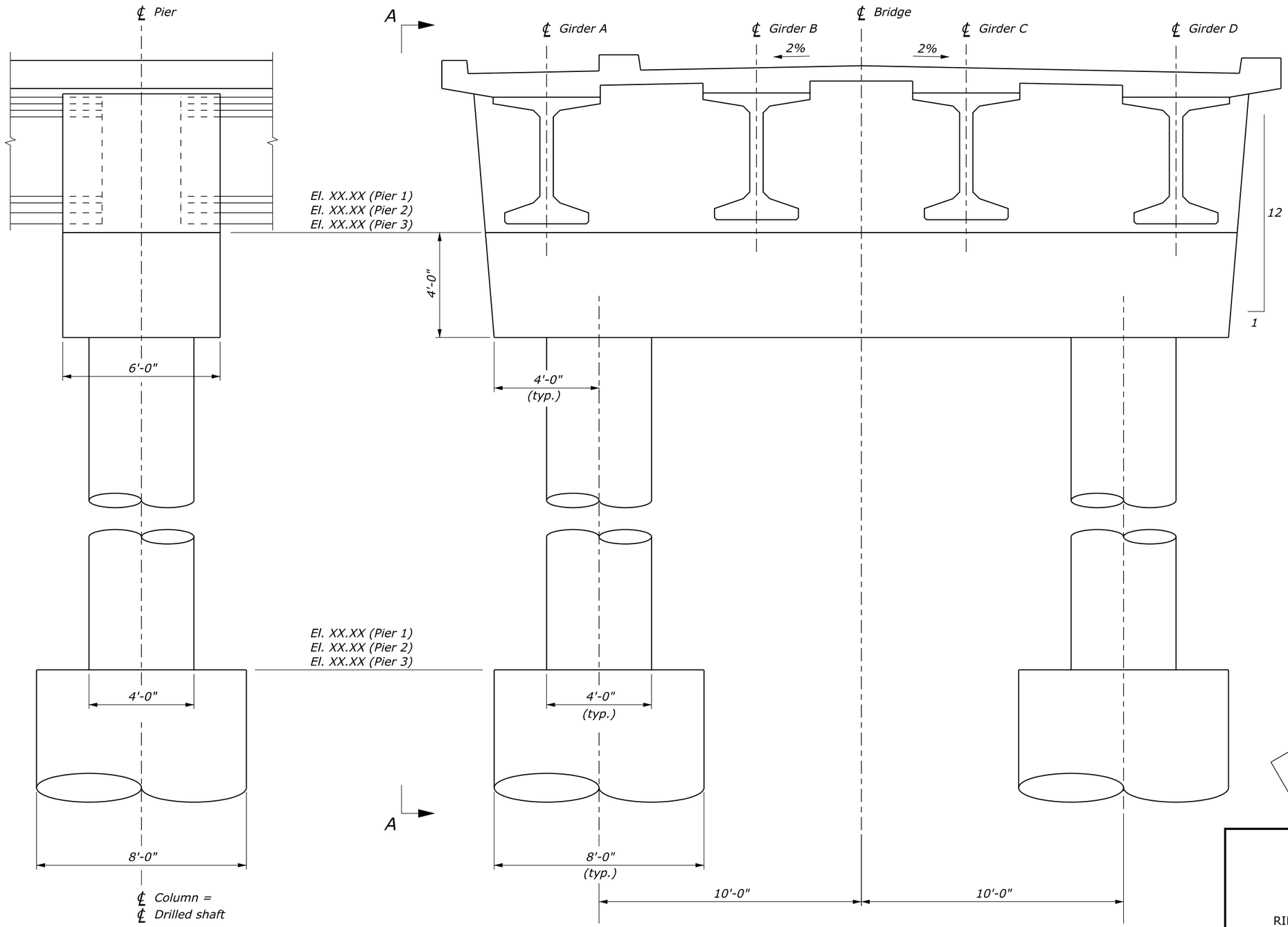
STATE	PROJECT	SHEET NUMBER



VIEW A-A

PIER ELEVATION

NOTE:
Railings not shown for clarity.

PRELIMINARY
NOT FOR CONSTRUCTION

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
WESTERN FEDERAL LANDS HIGHWAY DIVISION

LAKE RIVER BRIDGE

RIVER 'S' UNIT
RIDGEFIELD NATIONAL WILDLIFE REFUGE

CLARK COUNTY, WASHINGTON

TYPICAL PIER ELEVATION

NO.	DATE	BY	REVISIONS	NO.	DATE	BY	REVISIONS	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	PROJECT TEAM LEADER	BRIDGE DRAWING	DATE	DRAWING NO.
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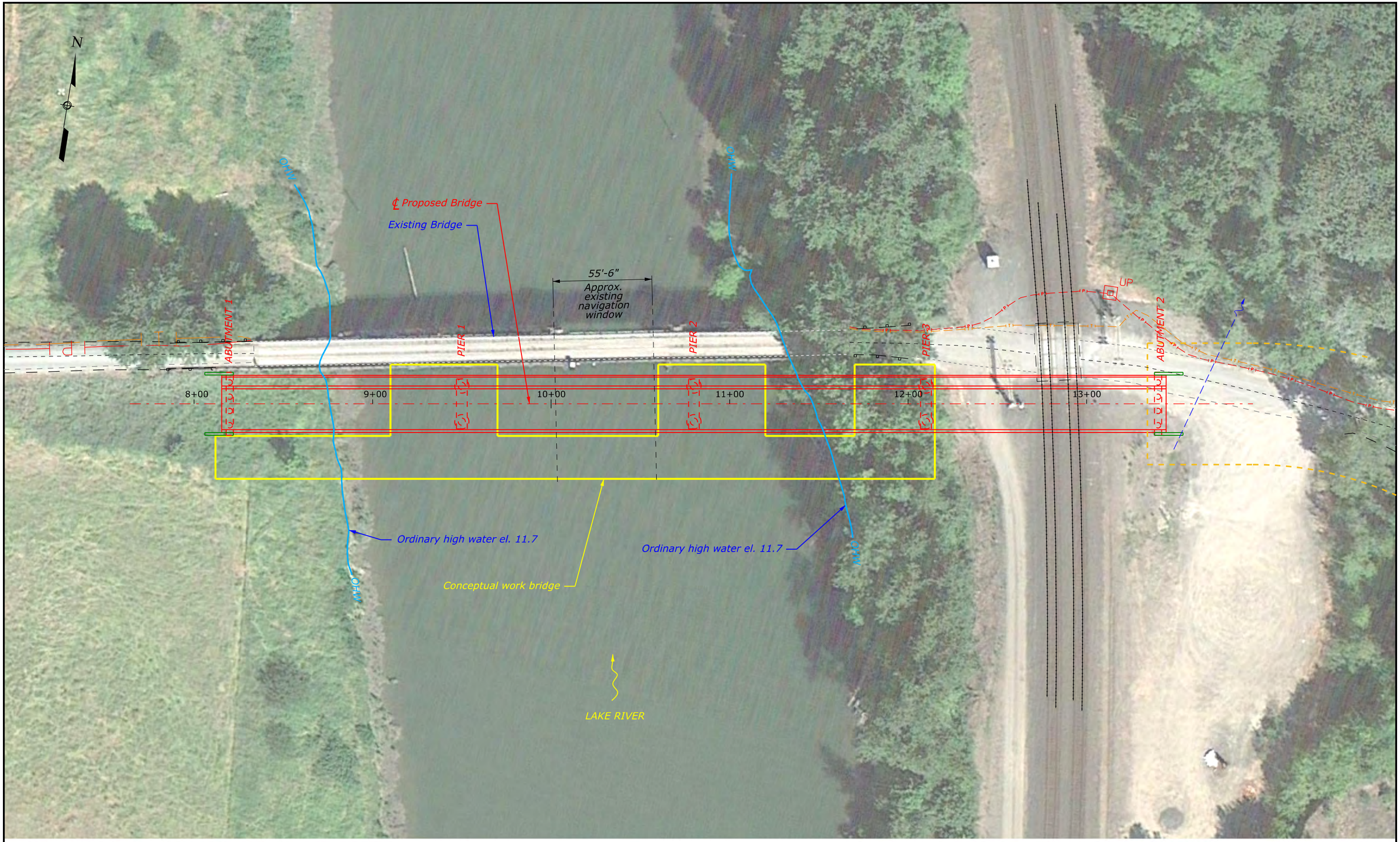
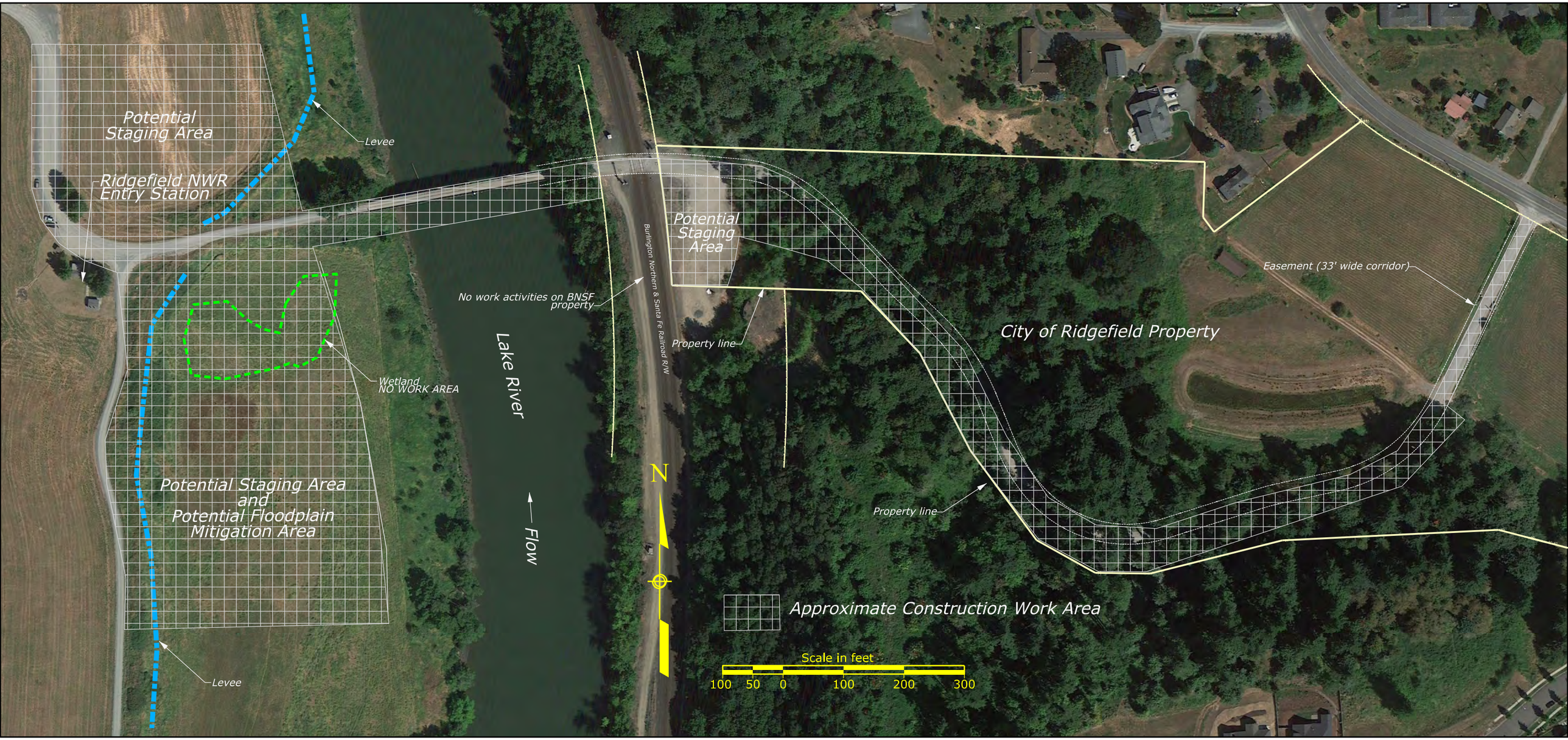


Scale in feet

50 25 0 50 100 150

LAKE RIVER BRIDGE
RIVER 'S' UNIT
RIDGEFIELD NATIONAL WILDLIFE REFUGE

CONCEPTUAL WORK BRIDGE



Note: Access road shown as construction work area becuase staging/traffic control may occur in this area. But no road work is planned.

APPENDIX 10
NMFS and USFWS
Impact Pile Driving Sound Attenuation Specifications

Western Washington Fish and Wildlife Office

Revised: October 31, 2006

INTRODUCTION

Air bubbles can reduce sound pressure levels (SPLs) at some frequencies by as much as 30 dB (Gisiner et al. 1998). Bubble curtains are essentially perforated pipes or hoses, surrounding the pile being driven, that produce bubbles when air is pumped through the perforations. Bubble curtains can also reduce particle velocity levels (MacGillivray and Racca 2005).

Bubble curtain designs are highly variable, but can generally be grouped in two categories: unconfined and confined. Unconfined systems are simply a frame which allows for transmission of air bubbles around a pile being driven. Confined systems add a sleeve around the pile to contain the bubbles. The sleeve can consist of fabric, hard plastic, or a larger pile (casing). Spacing of the bubble manifolds, air pressure, tidal currents, and water depth are all factors influencing effectiveness. Improper installation or operation can decrease bubble curtain effectiveness (Pommerenck 2006; Visconty 2004).

Reyff et al. (2002) evaluated the effectiveness of a confined system which used a foam-filled casing and bubble curtain. The casing was 12.5 ft (3.8 m) in diameter with the interior coated with 1 inch (2.54 cm) closed cell foam. The casing surrounded the pile being driven, and contained the bubble flow. This system dramatically reduced both peak pressure and rms levels. Peak pressure was reduced by 23 to 24 dB and rms levels were reduced by 22 to 28 dB.

A confined bubble curtain used in driving 24 in octagonal concrete piles at the Port of Benicia in San Francisco Bay, California, attenuated SPLs between 20 and 30 dB (Rodkin, 2003). At the Benicia Martinez Bridge project in California, the project proponents used a casing that was either dewatered, or included an air bubble system. Both techniques yielded substantial reductions in SPLs. The sleeve with an air bubble curtain reduced peak SPLs by up to 34 dB, which the authors note, equates to a 99 percent reduction in the overall energy of the impulse (Reyff et al, 2002). A confined bubble curtain used in driving 30 in (76 cm) steel piles at a Washington State Ferries facility in Eagle Harbor, Washington, attenuated SPLs by an average of 9.1 dB (MacGillivary and Racca, 2005).

During impact installation of steel piles in an embayment on the Columbia River an unconfined bubble curtain built using a design by Longmuir and Lively (2001) achieved a maximum reduction of 17 dB, although the results were variable (Laughlin 2006). Unconfined bubble curtains used in driving very large steel piles for bridges in San Francisco Bay, California, have attenuated SPLs by as much as 20 dB (Abbott and Reyff 2004). An unconfined bubble curtain used during installation of 24 in (61 cm) steel piles in the City of Vancouver, British Columbia, reduced SPLs by 17 dB (Longmuir and Lively, 2001). At Friday Harbor, Washington, the Washington State Ferries monitored steel pile driving with and without a bubble curtain (Visconty 2004).

Initially, the bubble curtain was improperly installed and no sound attenuation was observed. The bubble curtain was not placed firmly on the bottom; therefore, unattenuated sound escaped under the bubble curtain. After the bubble curtain was modified by adding weight and a canvas skirt to conform to the bottom contour of Puget Sound, the sound was reduced by up to 12 dB, with an average of 9 dB reduction. Vagle (2003) reported reductions of between 18 dB and 30 dB when using a properly designed bubble curtain.

In Washington, the effectiveness of both unconfined and confined systems has been variable and below that of other locations. This may be attributable to an incomplete understanding of design, deployment, and performance, and/or to site specific parameters such as substrate and driving depth. With a common set of design and performance specifications, variability should be minimized and limited to site specificity.

Unconfined Bubble Curtain Specifications:

1. General - An unconfined bubble curtain is composed of an air compressor(s), supply lines to deliver the air, distribution manifolds or headers, perforated aeration pipe, and a frame. The frame facilitates transport and placement of the system, keeps the aeration pipes stable, and provides ballast to counteract the buoyancy of the aeration pipes in operation.

2. The aeration pipe system shall consist of multiple layers of perforated pipe rings, stacked vertically in accordance with the following:

Water Depth (m)	No. of Layers
0 to less than 5	2
5 to less than 10	4
10 to less than 15	7
15 to less than 20	10
20 to less than 25	13

3. The pipes in all layers shall be arranged in a geometric pattern which shall allow for the pile being driven to be completely enclosed by bubbles for the full depth of the water column and with a radial dimension such that the rings are no more than 20 in (0.5 m) from the outside surface of the pile.

4. The lowest layer of perforated aeration pipe shall be designed to ensure contact with the substrate without burial and shall accommodate sloped conditions.

5. Air holes shall be 1/16 in (1.6 mm) in diameter and shall be spaced approximately 3/4 in (20 mm) apart. Air holes with this size and spacing shall be placed in four adjacent rows along the pipe to provide uniform bubble flux.

6. The system shall provide a bubble flux of 105 cubic ft (3.0 cubic m) per minute per linear meter of pipe in each layer (32.91 cubic ft [0.93 cubic m] per minute per linear foot [0.3 meter] of pipe in each layer). The volume of air per layer is the product of the bubble flux and the circumference of the ring:

$V_t = 3.0\ m^3/min/m$ * Circum of the aeration ring in meters

or

$V_t = 32.91\ ft^3/min/ft$ * Circum of the aeration ring in feet

7. Meters shall be provided as follows:
   a. Pressure meters shall be installed at all inlets to aeration pipelines and at points of lowest pressure in each branch of the aeration pipeline.
   b. Flow meters shall be installed in the main line at each compressor and at each branch of the aeration pipelines at each inlet. In applications where the feed line from the compressor is continuous from the compressor to the aeration pipe inlet the flow meter at the compressor can be eliminated.
   c. Flow meters shall be installed according to the manufactures recommendation based on either laminar flow or non-laminar flow.

   Performance: In Washington, unconfined bubble curtains have achieved a maximum of 17 dB attenuation and more typically range between 9 to 12 dB. Should hydroacoustic monitoring reveal that an unconfined bubble curtain is not achieving (to be determined based on site and project specific considerations), the NMFS and/or USFWS staff person on the project should be contacted immediately regarding modifications to the proposed action. Should attenuation rates continue at less than (to be determined based on site and project specific considerations), re-initiation of consultation may be necessary.

Confined Bubble Curtain Specifications:

1. General - A confined bubble curtain is composed of an air compressor(s), supply lines to deliver the air, distribution manifolds or headers, perforated aeration pipe(s), and a means of confining the bubbles.

   a. The confinement (fabric, plastic or metal sleeve, or equivalent) shall extend from the substrate to a sufficient elevation above the maximum water level expected during pile installation such that when the air delivery system is adjusted properly, the bubble curtain does not act as a water pump (*i.e.,* little or no water should be pumped out of the top of the confinement system).

   b. The confinement shaLl contain resilient pile guides that prevent the pile and the confinement from coming into contact with each other and do not transmit vibrations to the confinement sleeve and into the water column (rubber spacers, air filled cushions).

2. In water less than 50 ft (15 m) deep, the system shall have a single aeration ring at the substrate level. In waters greater than 50 ft (15 m) deep, the system shall have at least two rings, one at the substrate level and the other at mid-depth.

3. The lowest layer of perforated aeration pipe shall be designed to ensure contact with the substrate without sinking into the substrate and shall accommodate for sloped conditions.

4. Air holes shall be 1/16 in (1.6 mm) in diameter and shall be spaced approximately 3/4 in (20 mm) apart. Air holes with this size and spacing shall be placed in four adjacent rows along the pipe to provide uniform bubble flux.

5. The system shall provide a bubble flux of 105 cubic ft (3.0 cubic m) per minute per linear meter of pipe in each layer (32.91 cubic ft [0.93 cubic m] per minute per linear foot [0.3 meter] of pipe in each layer). The total volume of air per layer is the product of the bubble flux and the circumference of the ring:

$V_t = 3.0\ m^3/min/m$ * Circ of the aeration ring in meters

or

$V_t = 32.91\ ft^3/min/ft$ * Circ of the aeration ring in feet.

6. Meters shall be provided as follows:
   a. Pressure meters shall be installed at all inlets to aeration pipelines and at points of lowest pressure in each branch of the aeration pipeline.
   b. Flow meters shall be installed in the main line at each compressor and at each branch of the aeration pipelines at each inlet. In applications where the feed line from the compressor is continuous from the compressor to the aeration pipe inlet the flow meter at the compressor can be eliminated.
   c. Flow meters shall be installed according to the manufactures recommendation based on either laminar flow or non-laminar flow.

   Performance: In Washington, few projects have used confined bubble curtains so there is a lack of data. Based on performance in other locations, the effectiveness of a confined system could range from 9 dB to 30 dB. Should hydroacoustic monitoring reveal that a confined bubble curtain is not achieving (to be determined based on site and project specific considerations), the NMFS and/or USFWS staff person on the project should be contacted immediately regarding modifications to the proposed action. Should attenuation rates continue at less than (to be determined based on site and project specific considerations), re-initiation of consultation may be necessary.

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WSDOT Fish Exclusion Protocols and Standards

Work below the Ordinary High-Water Mark (or Mean Higher High-Water Mark) shall, in general, be conducted in isolation from flowing waters. Exceptions to this general rule or performance measure include: 1) implementation of the work area isolation and fish capture and removal protocols described in this document; 2) placement or removal of small quantities of material (e.g., wood or rock), or structural best management practices (e.g., turbidity curtain), under site conditions where potential exposures and effects to fish life are minimized without isolation from flowing waters[1]; and, 3) work conducted under a declared emergency, under emergency conditions, or where flow conditions prevent safe implementation of work area isolation and fish capture and removal protocols.

Implementation of the work area isolation and fish capture and removal protocols shall be planned and directed by a WSDOT biologist, or qualified biologist under contract to WSDOT, possessing all necessary knowledge, training, and experience (the directing biologist). If electrofishing will or may be used as a means of fish capture, the directing biologist shall have a minimum of 100 hours electrofishing experience in the field using similar equipment, and any individuals operating electrofishing equipment shall have a minimum of 40 hours electrofishing experience under direct supervision. All individuals participating in fish capture and removal operations shall have the training, knowledge, skills, and ability to ensure safe handling of fish, and to ensure the safety of staff conducting the operations.

The directing biologist shall work with Maintenance, Construction, and/or Environmental staff (as appropriate) to plan the staging and sequence for work area isolation, fish capture and removal, and dewatering. This plan should consider the size and channel characteristics of the area to be isolated, the method(s) of dewatering (e.g., diversion with bypass flume or culvert; diversion with sandbag, sheet pile or similar cofferdam; etc.), and what sequence of activities will provide the best conditions for safe capture and removal of fish. Where the area to be isolated is small, depths are shallow, and conditions are conducive to fish capture, it may be possible to isolate the work area and remove all fish life prior to dewatering or flow diversion. Where the area to be isolated is large, depths are not shallow, where flow volumes or velocities are high, and/or conditions are not conducive to easy fish capture, it may be necessary to commence with dewatering or flow diversion staged in conjunction with fish capture and removal. The directing biologist shall use his/her best professional judgment in deciding what sequence of activities is likely to minimize exposure of fish to conditions causing stress or injury (including stranding, exposure to extremes of temperature or reduced dissolved oxygen, risk of injury resulting from electrofishing, etc.).

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[1] WSDOT shall make this determination with consultation or input from the regulatory agencies with jurisdiction, including the Washington State Department of Fish and Wildlife (WDFW), U.S. Fish and Wildlife Service (FWS), and NOAA-National Marine Fisheries Service (NMFS) as appropriate; also, this exception shall not permit work that requires in-water excavation or that presents a risk of increased turbidity beyond the immediate work area or for a duration of more than 15 minutes.

The directing biologist shall plan work area isolation, fish capture and removal, and dewatering with consideration for the following: habitat connectivity and fish habitat requirements; the duration and extent of planned in-water work; anticipated flow and temperature conditions over the duration of planned in-water work; and, the risk of exposure to turbidity or other unfavorable conditions during construction. If the area to be isolated includes only a portion of the wetted channel width (e.g., large or deep rivers where diversion from the entirety of the wetted channel is difficult or impossible), or if the bypass flume or culvert will effectively maintain connectivity and fish passage for the duration of construction activities, it may be less important whether the fish are herded (and/or captured and released) upstream or downstream of the isolated work area. However, if the area to be isolated includes the entire wetted channel width, and especially if conditions make it unlikely that connectivity (i.e., upstream/downstream fish passage) can be effectively maintained for the duration of construction activities, then the directing biologist should carefully consider whether to herd fish (and/or capture and release fish) upstream or downstream of the isolated work area.

If conditions upstream of the isolated work area will or may become unfavorable during construction, then fish should not be herded or released to an upstream location; this situation is probably most common where the waterbody in question is small, where seasonal flows are substantially diminished, and conditions of elevated temperature and/or reduced dissolved oxygen are foreseeable. However, the directing biologist shall also consider whether planned in-water work presents a significant risk of downstream turbidity and sedimentation; fish herded or released to a downstream location may be exposed to these conditions.

If large numbers of fish are to be herded (and/or captured and released), and in order to avoid overcrowding or concentrating fish in areas where their habitat needs cannot be met, it may be appropriate to relocate fish both upstream and downstream of the isolated work area. At locations where habitat connectivity or quality is poor, including along reaches upstream and/or downstream of the isolated work area, the directing biologist should carefully consider whether relocated fish can meet their minimum habitat requirements for the duration of planned in-water work. On rare occasions it may be appropriate to relocate fish at a greater distance upstream and/or downstream (e.g., thousands of feet or miles), so as to ensure fish are not concentrated in areas where their habitat needs cannot be met, or where they may be exposed to unfavorable conditions during construction. On those rare occasions where relocation to a greater distance is deemed necessary, the WSDOT shall provide notice to the agencies with jurisdiction in advance of the operations.

Plans for staging work area isolation, fish capture and removal, and dewatering must comply with WSDOT safety requirements. Safe implementation is a high priority. The directing biologist shall design and adjust the plan as necessary to ensure the safety of all individuals implementing the plan. Under some conditions it may be appropriate to conduct work without isolation from flowing waters, without placement of block nets, fish capture or removal; for a discussion of this topic see page 1.

In order to comply with WSDOT safety requirements, work in or around water outside of daylight hours is not generally permissible. If, under unusual circumstances, the directing biologist identifies work that will or may be necessary outside of daylight hours, he/she shall coordinate and gain approval for this work with appropriate managers (including the WSDOT safety officer and/or supervisors with authority).

Work Area Isolation

The directing biologist shall determine appropriate locations for the placement of block nets, based on site characteristics and a consideration of the type and extent of planned in-water work. Sites that exhibit reduced flow volume or velocity, uniformity of depth, and good accessibility are preferred; sites with heavy vegetation, large cobble or boulders, undercut banks, deep pools, etc. should be avoided due to the difficulty of securing and/or maintaining nets. Sites with a narrow channel cross-section ("constriction") should be avoided if foreseeable flow conditions might overwhelm or dislodge the block nets, posts, or anchors.

Except when planning and intending to herd fish upstream, and upstream block net shall be placed first. With a block net secured to prevent movement of fish into the work area from upstream, a second block net should be used as a seine to herd fish in a downstream direction. Where the area to be isolated includes a culvert(s), deep pools, undercut banks, or other cover attractive to fish (e.g., thick overhanging vegetation, rootwads, logjams, etc.) it may be appropriate to isolate a portion or portions of the work area, rather than attempting to herd fish from the entirety of the work area in a single downstream pass. Fish capture and removal will be most successful if an effort is made to strategically focus and concentrate fish in areas where they can be easily seined and netted. Care shall be taken not to concentrate fish where they are exposed to sources of stress, or to leave them concentrated in such areas for a long duration (e.g., more than 30 minutes).

Depending upon site characteristics, and the planned staging and sequence for work area isolation and dewatering, it may or may not be necessary to place a downstream block net. Typically, however, site characteristics and/or the duration of planned in-water work will necessitate placement of a net(s) to prevent movement of fish into the work area from downstream. If groundwater seepage or site drainage has a tendency to re-wet the area, if the area to be isolated is low-gradient or subject to a backwatering influence, or if the area to be isolated is large and considerable effort will be expended in capturing and removing fish life, a downstream block net should be placed. If foreseeable flow conditions over the duration of planned in-water work might enable fish to re-enter the work area from downstream, a downstream block net should be placed.

In most instances where gradual dewatering or flow diversion is staged in conjunction with fish capture and removal, it is appropriate to delay installation of the downstream block net(s) until after fish have been given sufficient time to move downstream by their own choosing. If flows are reduced gradually over the course of several hours, or the length of an entire workday, some (perhaps many) fish will make volitional movements downstream beyond the area to be isolated. Gradual dewatering can be an effective

means by which to reduce the risk of fish stress or injury. Gradual dewatering and the encouragement of volitional movement are particularly important where the area to be isolated is large and may hold many fish. However, where the area to be isolated includes a culvert(s), deep pools, undercut banks, or other cover attractive to fish, some (perhaps many) fish will not choose to move downstream regardless of how gradually flows are reduced. The directing biologist should use his/her best professional judgment in deciding what sequence of activities is likely to minimize fish stress or injury (including stranding).

Where the area to be isolated is small, depths are shallow, and conditions are conducive to fish capture, it may be possible to remove all fish life prior to dewatering, or to implement plans for dewatering staged with fish capture over a relatively short timeframe (e.g., 1-2 hours). Where the area to be isolated is large, depths are not shallow, where flow volumes or velocities are high, and/or conditions are not conducive to easy fish capture, dewatering or flow diversion should be staged in conjunction with fish capture and removal over a longer timeframe (e.g., 3-6 hours). The largest areas and/or most difficult site conditions may warrant or require that plans for dewatering and fish capture proceed over the length of an entire workday, or multiple workdays. Where this is the case, fish should be given sufficient time and a means to move downstream by their own choosing so as to reduce the total number of fish exposed to sources of stress and injury (including fish handling).

The directing biologist shall select suitable block nets. Type of material, length, and depth may vary based on site conditions. It may be necessary and appropriate to contact other WSDOT Regions or offices with access to nets (or other materials) suitable for placement under unique or unusual circumstances. Typically block nets will be composed of 9.5 millimeter stretched nylon mesh and should be installed at an angle to the direction of flow (i.e., not directly perpendicular to flow) so as to reduce the risk of impinging fish. Anchor bags filled (or half-filled) with clean, washed gravel are preferred over sandbags, especially for nets and anchors that will or may remain in-place for a long duration (i.e., more than two weeks). Any use or movement of native substrates or other materials found on-site should be incidental and shall not appreciably affect channel bed or bank conditions.

Block nets shall remain in place until work is complete and conditions are suitable for the reintroduction of fish[2]. Block nets require frequent inspection and debris removal. A qualified biologist, or other field staff trained in safe fish handling, shall be assigned the responsibility of inspecting the nets and safely capturing and relocating any impinged fish. The frequency of these inspections shall be determined on a case-by-case basis However, block nets shall, at a minimum, be inspected for impinged fish (especially

[2] If plans for work area isolation and fish capture and removal include the installation of temporary cofferdams, and once the directing biologist has confirmed fish life have been successfully excluded from the entire area enclosed by the cofferdam(s), it may be appropriate to remove block nets and allow fish to re-enter the previously isolated work area; this approach is particularly relevant and appropriate where many weeks or months of construction are planned for completion within temporary cofferdams (i.e., isolated from flowing waters).

juvenile fish) at least three times daily for the first 48 hours after installation (approximate), and for the first 24 hours after significant rainfall (or change in flow volume or velocity). In the event fish are found impinged on the net(s), or if weather or flow conditions change significantly, the directing biologist shall reconsider and adjust the frequency of net inspections so as to minimize the risk of impinging and injuring fish.

Field staff shall be assigned the responsibility of frequently checking and maintaining the nets for accumulated debris, general stability, and proper function. The frequency of these inspections shall be determined on a case-by-case basis, dependent upon the site, seasonal, and weather conditions. Block nets must be secured along both banks and the channel bottom to prevent failure as a result of debris accumulation, high flows, and/or flanking. Some locations may require additional block net support (e.g., galvanized hardware cloth, affixed metal fence posts, etc.).

Fish Capture and Removal

If dewatering and/or flow diversion are deemed necessary, this work (including related fish capture and removal operations) shall comply with any provisions contained in the Hydraulic Project Approval (HPA), or applicable General HPA, issued by the WDFW. If the FWS and/or NMFS have provided relevant Terms and Conditions from a Biological Opinion addressing the work (or action), this work shall also comply with those Terms and Conditions.

If pumps are used to temporarily bypass water or to dewater residual pools or cofferdams, pump intakes shall be screened to prevent aquatic life from entering the intake. Fish screens or guards shall comply with Washington State law (RCW 77.57.010 and 77.57.070), with guidelines prescribed by the NMFS[3], and any more stringent requirements contained in the HPA or General HPA issued by the WDFW. If pumps are to be used on a more permanent basis, as the primary or secondary method for diverting flow around the isolated work area, plans for dewatering shall address contingencies (i.e., extremes of flow or weather). These plans shall include ready access to a larger or additional "back-up" pump with screened intake. If the directing biologist has confirmed that all fish life has been successfully excluded from the area, if there is no risk of entraining fish, and adequate plans are in-place to address contingencies (including a routine schedule for inspection), then pumps may be operated without a screened intake.

<u>Fish Capture and Removal Methods</u>:

Methods for safe capture and removal of fish from the isolated work area are described below. These methods are given in order of preference. At most locations, a combination of methods will be necessary. In order to avoid and minimize the risk of injury to fish, attempts to seine and/or net fish should always precede the use of electrofishing equipment. Visual observation techniques (e.g. snorkeling, surveying with

[3] National Marine Fisheries Service. 2011. Anadromous Salmonid Passage Facility Design. Chapter 11: Fish Screen and Bypass Facilities. NMFS Northwest Region, July 2011, 140 p..

polarized glasses or Plexiglas bottomed buckets, etc.) may be used to assess the effectiveness of these methods, to identify locations where fish are concentrating, or otherwise adjust methods for greater effectiveness.

If the planned fish capture and removal methods have not been addressed through consultation (or programmatic consultation), if seining and netting are impracticable (i.e., electrofishing s deemed the only viable means of fish capture), and fish listed under the ESA will or may be present, the directing biologist shall provide notice to the FWS and/or NMFS (as appropriate). This notice shall be provided in advance of the operations, and shall include an explanation of the unique site conditions or circumstances. Work conducted under a declared emergency (or emergency conditions) shall follow established ESA notification protocols. Projects that operate under conditions of the NMFS or USFWS 10(a)1(A) Scientific Collection or the WDFW Scientific Collection permit may have additional notification requirements.

Where fish listed under the ESA will or may be present, the directing biologist shall insure that fish capture and removal operations adhere to the following minimum performance measures or expectations:

1) Only dip nets and seines composed of soft (non-abrasive) nylon material shall be used.

2) The operations shall not resort to the use of electrofishing equipment unless and until other, less injurious methods have been effective in removing most or all of the adult and sub-adult fish (i.e., fish in excess of 300 millimeters, ~ 12 inches); the operations shall conduct a minimum of three complete passes without capture using seines and/or nets.

3) The operations shall confirm success of fish capture and removal before completely dewatering or commencing with other work within the isolated work area; the operations shall conduct a minimum of two complete passes without capture using electrofishing equipment.

4) Fish listed under the ESA shall not be held in containers for more than 10 minutes, unless those containers are dark-colored, lidded, and fitted with a portable aerator.

5) A plan for achieving efficient return to appropriate habitat will be developed before the capture and removal process.

6) Every attempt will be made to release ESA-listed specimens first.

• **Seining** shall be the preferred method for fish capture. Other methods shall be used when seining is not possible, or when/after attempts at seining have proven ineffective. Seines, once pursed, should remain partially in the water while fish are removed with dip nets. Seines with a “bag” minimize handling stress and are preferred. Seines with a bag

are also preferred where obstructions make access to the water (or deployment/retrieval of the seine) difficult.

In general, seining will be more effective if fish, especially juvenile fish, are moved (or "flushed") out from under cover. Methods which may increase effectiveness and/or efficiency include conducting seining operations at dawn or dusk (i.e., during low-light conditions), in conjunction with snorkeling, and/or flushing of the cover. In flowing waters, and especially where flow volume or velocity is high or moderately-high, seines that employ a heavy lead line and variable mesh size are preferred. Small mesh sizes are more effective across the full range of fish size (and age class), but also increase resistance and can make deployment/retrieval more difficult in flowing waters. Seines which use a small mesh size in the bag (or body), and a larger, less resistant mesh size in the wings may under some conditions be most effective and efficient.

• **Baited Minnow Traps** are typically used before and in conjunction with seining. Traps may be left in the isolated work area overnight. Traps shall be inspected at least four times daily to remove captured fish and thereby minimize predation within the trap. Traps should be checked more frequently if temperatures are in excess of 15 degrees C (59°F).
Predation within the trap may be an unacceptable risk when/where minnow traps are left in-place overnight; large sculpin and other predators that feed on juvenile fish are typically much more active at night. The directing biologist shall consider the need and plan for work outside daylight hours (i.e., inspection and removal) before leaving minnow traps in-place overnight.

• **Dip Nets** shall be used in conjunction with seining. This method is particularly effective when employed during gradual dewatering or flow diversion. To be most effective, and to minimize stress and risk of injury to fish (including stranding), the directing biologist shall coordinate fish capture operations with plans for dewatering or flow diversion. Plans for dewatering and/or flow diversion should proceed at a measured pace (within constraints), to encourage the volitional downstream movement of fish, and reduce the risk of stranding. Plans for dewatering and/or flow diversion shall not proceed unless there are sufficient staff and materials on-site to capture and safely remove fish in a timely manner. Generally, this will require a minimum of two persons (three if electrofishing), but the directing biologist may find that some sites (especially large or complicated sites) warrant or require a more intensive effort (i.e., additional staffing).

Once netted, fish shall remain partially in water until transferred to a bucket, cooler, or holding tank. Dip nets which retain a volume of water ("sanctuary nets") are preferred. However, sanctuary nets may be ineffective where flow volume or velocity is high or moderately-high (i.e., increase resistance lessens ability to net or capture fish). In addition, where water depths are very shallow and/or fish are concentrated in very small receding pools or coarse substrate, "aquarium" nets may be a better, more effective choice. Use of dip nets in conjunction with snorkeling, flushing of the cover, or around the hours of dawn or dusk (i.e., during low light conditions), can be effective for capturing fish sheltered below cover.

• **Connecting Rod Snakes** may be used to flush fish out of stream crossing structures (i.e., culverts). Connecting rod snakes are composed of wood sections approximately three feet in length. Like other cover attractive to fish, culverts (especially long culverts), can present a challenge to fish capture and removal operations. The directing biologist should plan a strategy for focusing and concentrating fish in areas where they can be easily seined and netted, and should take active steps to prevent fish from evading capture. When first implementing plans for work area isolation, fish capture and removal, and dewatering, it may be appropriate to place block nets immediately upstream and/or downstream of culverts so as to minimize the number of fish that might seek cover within the culvert(s). Once most or all of the fish have been removed from other parts of the work area, the block net placed downstream of the culvert(s) should be removed to encourage volitional downstream movement of fish.

• **Electrofishing** shall be performed only when other methods of fish capture and removal have proven impracticable or ineffective at removing all fish. The directing biologist shall ensure that attempts to seine and/or net fish always precede the use of electrofishing equipment. Larger fish (i.e., adult and sub-adult fish with comparatively longer spine lengths) are more susceptible to electrofishing injury than smaller fish. To minimize the risk of injury (and the number of fish potentially injured), the directing biologist shall confirm that other methods have been effective in removing most or all of the adult and sub-adult fish before resorting to the use of electrofishing equipment; see the related performance measure appearing on page 6. As a general rule or performance measure, electrofishing should not be conducted under conditions that offer poor visibility (i.e., visibility of less than 0.5 meter).

The following performance measures shall apply to the use of electrofishing equipment as a means of fish capture and removal:

1. If the planned fish capture and removal operations have not been addressed through consultation (or programmatic consultation), and fish listed under the ESA will or may be present, WSDOT shall provide notice to the FWS and/or NMFS prior to the initiation of electrofishing attempts. Upon request, the WSDOT shall permit the FWS, NMFS, and/or their designated representative to observe fish capture and removal operations. Work conducted under a declared emergency (or emergency conditions) shall follow established ESA notification protocols.

2. Electrofishing shall only be conducted when a biologist with at least 100 hours of electrofishing experience is on-site to conduct or direct all related activities. The directing biologist shall be familiar with the principles of electrofishing, including the effects of voltage, pulse width and pulse rate on fish, and associated risk of injury or mortality. The directing biologist shall have knowledge regarding galvanotaxis, narcosis and tetany, their relationships to injury/mortality rates, and shall have the ability to recognize these responses when exhibited by fish.

3. The directing biologist shall ensure that electrofishing attempts use the minimum voltage, pulse width, and rate settings necessary to create the desired response (galvonotaxis). Water conductivity shall be measured in the field prior to each electrofishing attempt to determine appropriate settings. Electrofishing methods and equipment shall comply with guidelines outlined by the NMFS[4].

4. The initial and maximum settings identified below shall serve as guidelines when electrofishing in waters that may support ESA-listed fish. Only DC or pulsed DC current shall be used. [Note: some newer, late-model electrofishing equipment includes a "set-up" or initialization function; the directing biologist shall have the discretion to use this function as a means to identify proper initial settings.]

Guidelines for initial and maximum settings for backpack electrofishing.[5]

	Initial Settings	**Conductivity (µS/cm)**	**Maximum Settings**
Voltage	100 V	≤ 300 300-350	800 V 400 V
Pulse Width	500µs		5 ms
Pulse Rate	15 Hz		60 Hz (In general, exceeding 40 Hz will injure more fish)

Each attempt shall begin with low settings for pulse width and pulse rate. If fish present in the area being electrofished do not exhibit a response, the settings shall be gradually increased until the appropriate response is achieved (galvanotaxis). The lowest effective settings for pulse width, pulse rate and voltage shall be used to minimize risks to both personnel and fish. Safe implementation is a high priority. The directing biologist shall ensure the safety of all individuals assisting with electrofishing attempts; this includes planning for and providing all necessary safety equipment and materials (e.g., insulated waders and gloves, first aid/CPR kit, a current safety plan with emergency contacts and phone numbers, etc.). Only individuals that are trained and familiar with the use of electrofishing equipment should provide direct assistance during electrofishing attempts.

5. Electrofishing shall not be conducted where spawning adults or redds with incubating eggs may be exposed to the electrical current. As a general rule or performance measure, waters that support anadromous salmon should not be electrofished from October 15 through May 15, and resident waters from November 1 through May 15. If located within waters that may support bull trout, especially waters located within a local bull trout population (i.e., that support spawning and rearing), seasonal limitations on the use of electrofishing equipment may be more restrictive; if you have questions, contact the

[4] National Marine Fisheries Service. 2000. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act
[5] Adapted from NMFS Backpack Electrofishing Guidelines, June 2000, and WDFW Electrofishing Guidelines for Stream Typing, May 2001

FWS. If any more restrictive work windows have been identified through consultation, those windows shall apply. The directing biologist shall ensure that electrofishing attempts are made only during appropriate times of year, and not where spawning adults or redds with incubating eggs may be exposed to the electrical current.

6. An individual shall be stationed at the downstream block net(s) during electrofishing attempts to recover stunned fish in the event they are flushed downstream and/or impinged against the block net(s).

7. The operator shall use caution so as to prevent fish from coming into direct contact with the anode. Under most conditions, the zone of potential fish injury extends approximately 0.5 meter from the anode. Netting shall not be attached to the anode, as this practice presents an increased risk of direct contact and injury. Extra care shall be taken near in-water structures or undercut banks, in shallow waters, or where fish densities are high. Under these conditions fish are more likely to come into close or direct contact with the anode and/or voltage gradients may be intensified. Voltage and other settings shall be readjusted to accommodate changing conditions in the field, including channel depth. When electrofishing areas near undercut banks, overhanging vegetation, large cobble or boulders, or where structures provide cover, fish that avoid capture may be exposed to the electrical current repeatedly. Repeated or prolonged exposures to the electrical current present a higher risk of injury, and therefore galvanotaxis should be used to draw fish out of cover.

8. Electrofishing shall be conducted in a manner that minimizes harm to fish. Once an appropriate fish response (galvanotaxis) is achieved, the isolated work area shall be worked systematically. The number of passes shall be kept to a minimum, but is dependent upon the numbers of fish and site characteristics and shall be at the discretion of the directing biologist. Electrofishing shall not be conducted unless there are sufficient staff and materials on-site, to both minimize the number of passes required and to locate, net, recover, and release fish in a timely manner. Generally, this will require a minimum of three persons, but the directing biologist may find that some sites (especially large or complicated sites) warrant or require a more intensive effort (i.e., additional staffing). Care shall be taken to remove fish from the electrical field immediately and to avoid exposing the same fish repeatedly. Fish shall not be held in dip nets while electrofishing is in progress (i.e., while continuing to capture additional fish). [Note: where flow velocity or turbulence is high or moderately-high (e.g., within riffles) it may be difficult to see and net fish; these fish may evade capture (resulting in repeated exposure), or may become impinged on the downstream block net(s); a “frame” net, or small portable block net approximately 3 feet in width, can be effective under these conditions when held downstream in close proximity to the anode.]

9. The condition of captured fish shall be carefully observed and documented. Dark bands on the body and/or extended recovery times are signs of stress or injury. When such signs are noted, settings for the electrofishing unit may require readjustment. The directing biologist should also review and consider changes to the manner in which the electrofishing attempt is proceeding. If adjustments to the electrofishing attempt do not

lessen the frequency (or severity) of observed stress, the directing biologist shall have the authority to postpone fish capture and removal operations[6]. Each fish shall be capable of remaining upright and actively swimming prior to release (*See* Fish Handling, Holding and Release).

10. Electrofishing shall not be conducted when turbidity reduces visibility to less than 0.5 meter, when water conductivity exceeds 350 µS/cm, or when water temperature is above 18°C (64°F) or below 4°C (39°F).

Fish Handling, Holding and Release:

• Fish handling shall be kept to the minimum necessary to remove fish from the isolated work area. Fish capture and removal operations shall be planned and conducted so as to minimize the amount and duration of handling. The operations shall maintain captured fish in water to the maximum extent possible during seining/netting, handling, and transfer for release.

• The directing biologist shall document and maintain accurate records of the operations, including: fish species, number, age/size class estimate, condition at release, and release location. Fish shall not be sampled or anesthetized, unless for valid purposes consistent with the WSDOT's Section 10 scientific collection permits.

• Individuals handling fish shall ensure that their hands are free of harmful and/or deleterious products, including but not limited to sunscreen, lotion, and insect repellent.

• The operations shall ensure that water quality conditions are adequate in the buckets, coolers, or holding tanks used to hold and transfer captured fish. The operations shall use aerators to provide for clean, cold, well-oxygenated water, and/or shall stage capture, temporary holding, and release to minimize the risks associated with prolonged holding. The directing biologist shall ensure that conditions in the holding containers are monitored frequently and operations adjusted appropriately to minimize fish stress. If fish listed under the ESA will or may be held for more than a few minutes prior to release, the directing biologist should consider using dark-colored, lidded containers only. Fish listed under the ESA shall not be held in containers for more than 10 minutes, unless those containers are dark-colored, lidded, and fitted with a portable aerator; small coolers meeting this description are preferred over buckets.

• The operations shall provide a healthy environment for captured fish, including low densities in holding containers to avoid effects of overcrowding. Large fish shall be kept separate from smaller fish to avoid predation. The operations shall use water-to-water transfers whenever possible.

[6] If the FWS and/or NMFS have provided an Incidental Take Statement from a Biological Opinion addressing the work (or action), the directing biologist shall ensure limits on take have not been exceeded; if the limits on take are exceeded, or if take is approaching these limits, the directing biologist shall postpone fish capture and removal operations and immediately notify the federal agency (or agencies) with jurisdiction.

• The release site(s) shall be determined by the directing biologist. The directing biologist should consider both site characteristics (e.g., flow, temperature, available refuge and cover, etc.) and the types of fish captured (e.g., out-migrating smolt, kelt, prespawn migrating adult, etc.) when selecting a release site(s). More than one site may be designated to provide for varying needs, and to separate prey-sized fish from larger fish. The directing biologist shall consider habitat connectivity and fish habitat requirements, seasonal flow and temperature conditions, and the duration and extent of planned in-water work when selecting a fish release site(s). If conditions upstream of the isolated work area will or may become unfavorable during construction, then fish should not be released to an upstream location. However, the directing biologist shall also consider whether planned in-water work presents a significant risk of downstream turbidity and sedimentation; fish released to a downstream location may be exposed to these conditions. Site conditions may warrant releasing fish both upstream and downstream, or relocating fish at a greater distance (e.g., thousands of feet or miles), so as to ensure fish are not concentrated in areas where their habitat needs cannot be met. For a fuller discussion of this topic see page 2.

• The directing biologist shall ensure that each fish is capable of remaining upright and has the ability to actively swim upon release.

• Any ESA-listed fish incidentally killed as a result of fish capture and removal operations shall be preserved and delivered to the appropriate authority upon request (see Documentation).

• If the limits on take of ESA-listed species are exceeded (harm or harassment), or if incidental take is approaching and may exceed specified limits, the directing biologist shall postpone fish capture and removal operations and immediately notify the federal agency (or agencies) with jurisdiction. If dewatering or flow diversion is incomplete and still in-progress, WSDOT shall take remedial actions directed at maintaining sufficient quantity and quality of flow and lessening sources of fish stress and/or injury. If conditions contributing to fish stress and/or injury may worsen before the federal agency with jurisdiction can be contacted, WSDOT should attempt to move fish to a suitable location near the capture site while keeping fish in water and reducing stress as much as possible.

Invasive or exotic fish species may be encountered during fish handling. WDFW is currently working on protocols for disposal of some of these species. WDFW does require the disposal of all prohibited fish species under WAC 220-12-090 (see Appendix for species list). The WDFW Area Habitat Biologist should be notified after the capture/disposal of any prohibited species.

Reintroduction of Flow and Fish to the Isolated Work Area

If conducting work in isolation from flowing waters has required placement of a block net(s), fish capture and removal, and temporary dewatering, the directing biologist shall

ensure that the block net(s) remain in place until work is complete and conditions are suitable for the reintroduction of fish. Flows shall be gradually reintroduced to the isolated work area, so as to prevent channel bed or bank instability, excessive scour, or turbidity and sedimentation. The directing biologist shall inspect the work area and downstream reach to ensure no fish are stranded or in distress during reintroduction of flows. If conditions causing or contributing to fish stress and/or injury are observed, WSDOT shall take remedial actions directed at lessening these sources of stress. This may include a more gradual reintroduction of flow, so as to reduce resulting turbidity and sedimentation.

All temporary structures and materials (e.g., block nets, posts, and anchors; bypass flume or culvert; sandbag, sheet pile or similar cofferdam; etc) shall be removed at the completion of work. The directing biologist shall document in qualitative terms the final condition of the isolated work area (including temporary bypass). The directing biologist shall identify and document any obvious signs of channel bed or bank instability resulting from the work, and shall report these conditions to the appropriate Maintenance, Construction, and/or Environmental staff for remedy. WSDOT shall document any additional actions taken to correct channel instability, and the final condition of the isolated work area (including temporary bypass).

To avoid and minimize the risk of introducing or spreading nuisance or invasive species, aquatic parasites, or disease, the directing biologist shall ensure that all equipment and materials are cleaned and dried before transporting them for use at another site or waterbody. See WDFW's "Invasive Species Management Protocols" (2011) for more information on decontamination methods.[7]

Documentation

- All work area isolation, and fish capture and handling shall be documented in a log book with the following information: project location, date, methods, personnel, water temperature, conductivity, visibility, electrofishing equipment settings, and other comments.

- All fish captured or handled shall be documented: species, number of each species, age/size class estimate, condition at release, and location of release.

- If at any time, fish are observed in distress, a fish kill occurs, or water quality problems develop (including equipment leaks or spills), WSDOT shall provide immediate notification to the WDFW consistent with any provisions contained in the HPA (or applicable General HPA). Notification shall consist of a phone call or voice mail message directed to the Area Habitat Biologist identified on the HPA and/or the Washington Military Department Emergency Management Division at (800) 258-5990, as appropriate.

[7] Tweit, B. A. Pleus, J. Kerwin, M. Hayes, C. Klein, S. Kelsey, M. Schmuck, L. Phillips, B. Hebner. 2011. Invasive Species Management Protocols. Version 1-2011. Washington Department of Fish and Wildlife.

• Any ESA-listed species incidentally killed as a result of fish capture and removal operations shall be documented with the notification provided to the appropriate authority (FWS and/or NMFS) consistent with any provisions contained in the applicable biological opinion. Initial notifications shall consist of a phone call or voice mail message. Initial notifications shall be directed to the following: (FWS) the nearest FWS Law Enforcement Office, and the Washington Fish and Wildlife Office at (360) 753-9440; (NMFS) the NMFS Office of Law Enforcement at (800) 853-1964, and the Washington State Habitat Office at (360) 753-9530. Any dead specimens shall be kept whole and preserved on-ice or frozen until WSDOT receives a response and further directions from the appropriate authority; if WSDOT receives no response within 5 working days, the directing biologist shall have the discretion to dispose of specimens. Initial notifications shall be followed by a second notification in writing. All notifications shall provide at a minimum the following: date, time, WSDOT point-of-contact (the directing biologist and/or supervisor), project name (and FWS and/or NMFS tracking number if available), precise location of any incidentally killed or injured and unrecovered fish, number of specimens and species, and cause of death or unrecoverable injury. If the limits on incidental take are exceeded (harm or harassment), the written notification shall also include an explanation of the circumstances causing or contributing to observed levels of take.

• The final condition of the isolated work area (including temporary bypass) shall be documented in qualitative terms, including any obvious signs of channel bed or bank instability resulting from the work. WSDOT shall document any additional actions taken to correct channel instability, and the final condition of the isolated work area (including temporary bypass).

Appendix A. Prohibited Species under WAC 220-12-090

Family Amiidae: Bowfin, grinnel, or mudfish, *Amia calva*.

Family Channidae: China fish, snakeheads: All members of the genus *Channa*.

Family Characidae: Piranha or caribe: All members of the genera *Pygocentrus*, *Rooseveltiella*, and *Serrasalmus*.

Family Clariidae: Walking catfish: All members of the family.

Family Cyprinidae:

- Fathead minnow, *Pimephales promelas*.
- Carp, Bighead, *Hypopthalmichthys nobilis*.
- Carp, Black, *Mylopharyngodon piceus.*
- Carp, Grass (in the diploid form), *Ctenopharyngodon idella*.
- Carp, Silver, *Hypopthalmichthys molitrix*.
- Ide, silver orfe or golden orfe, *Leuciscus idus*.
- Rudd, *Scardinius erythropthalmus*.

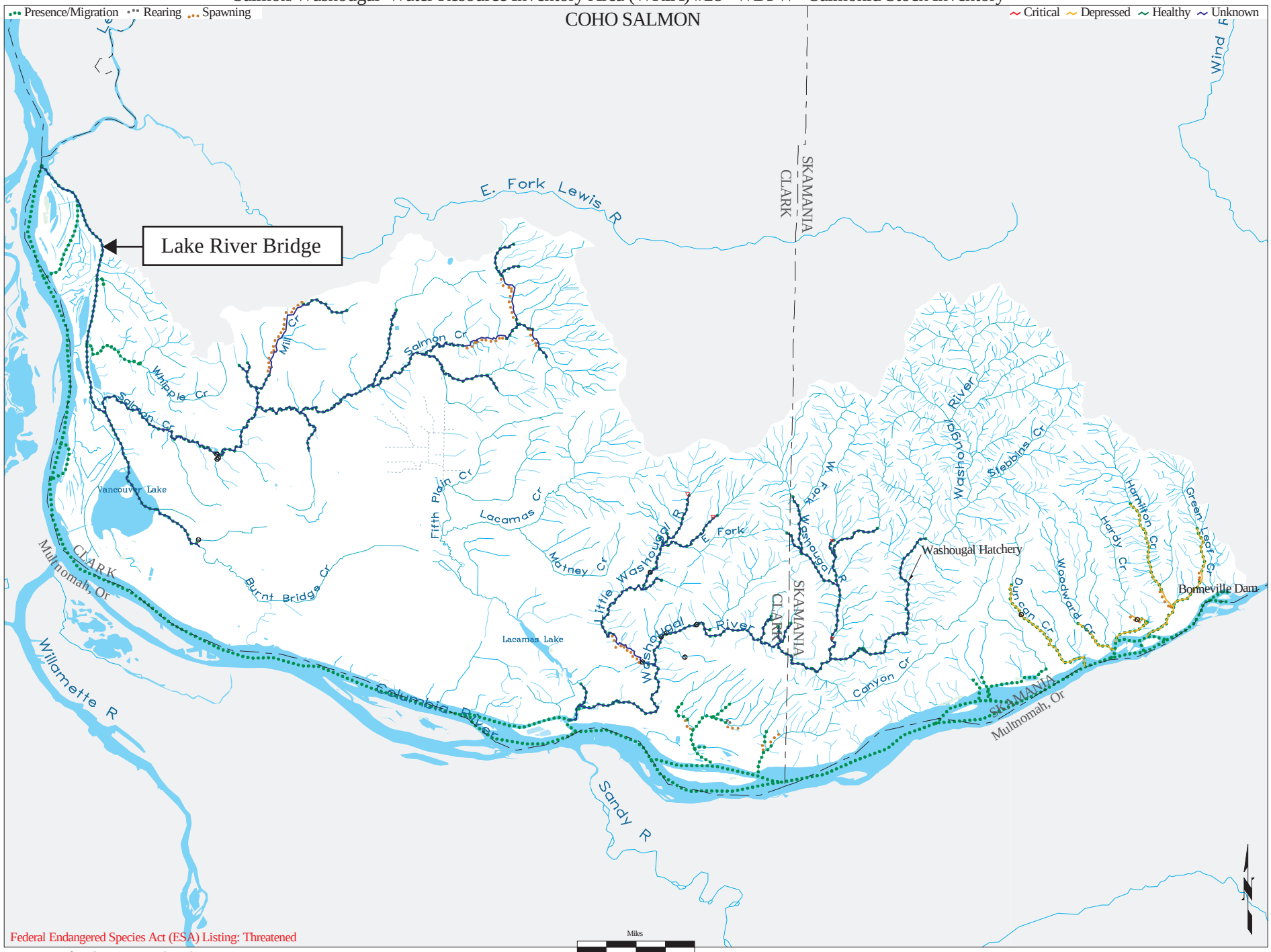
Family Gobiidae: Round goby, *Neogobius melanostomus*.

Family Esocidae: Northern pike, *Esox lucius*: A person may possess and transport dead prohibited Northern pike obtained under the department's recreational sport fishing rules (WAC 220-56-100 and 220-56-115). There is no minimum size, no daily limit, and no possession limit. Release of any live Northern pike into water other than the water being fished is prohibited.

Family Lepisosteidae: Gar-pikes: All members of the family.

Appendix C: Fish Distribution

Salmon/Washougal Water Resource Inventory Area (WRIA) #28 WDFW - Salmonid Stock Inventory

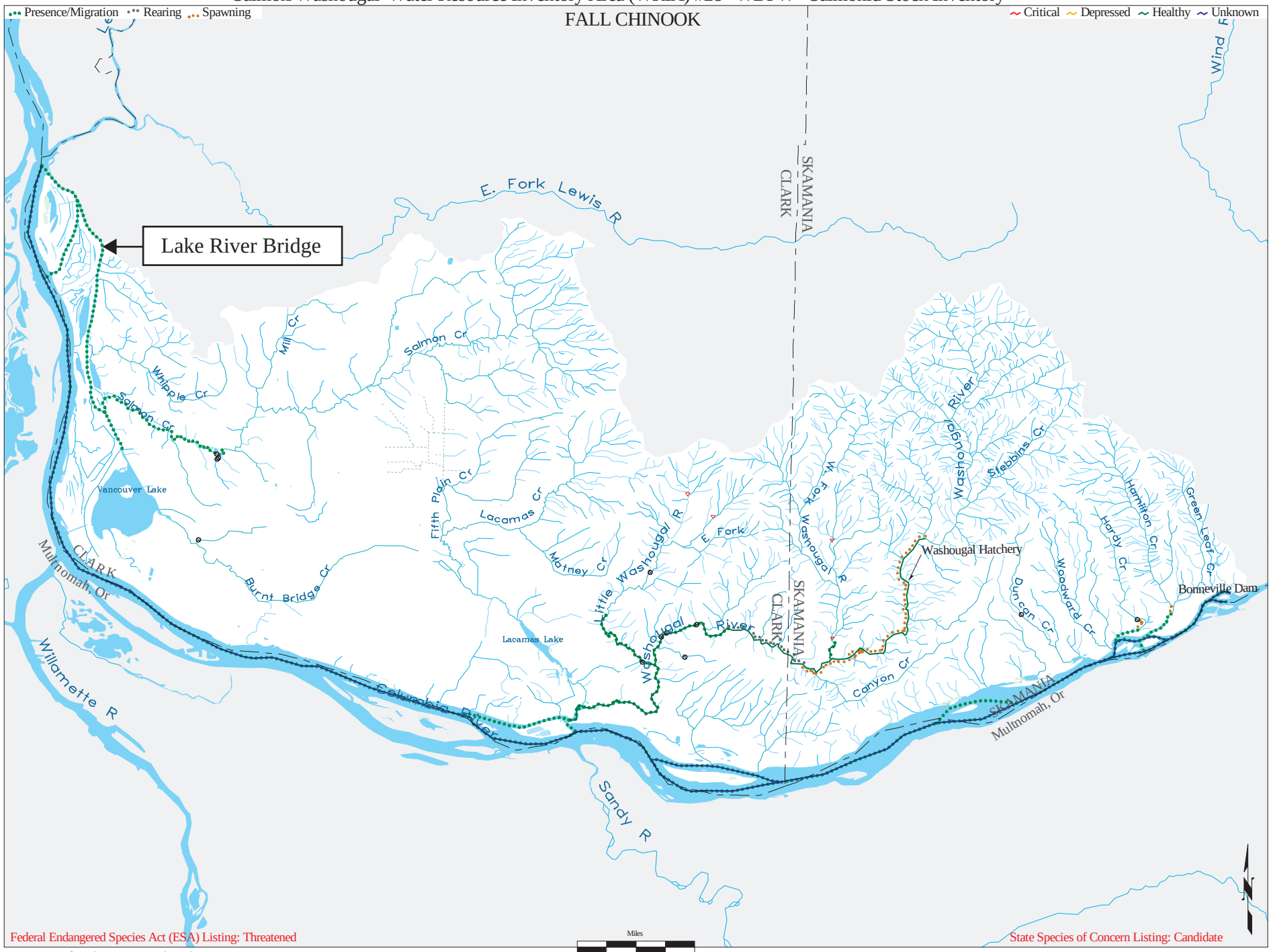


Federal Endangered Species Act (ESA) Listing: Threatened

Wa. Dept. of Ecology, GIS Technical Services 05/30/08

COHO28

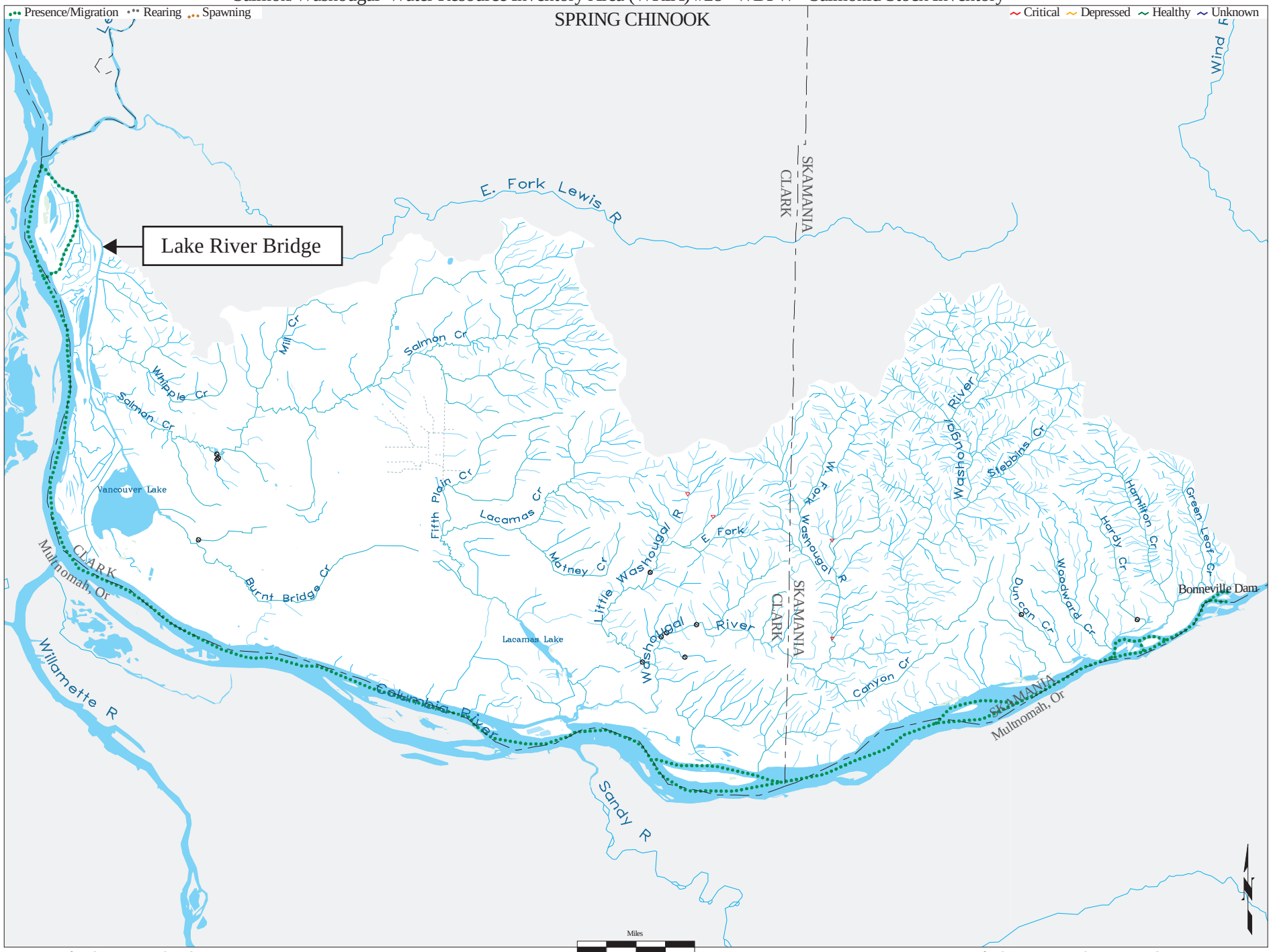
Salmon/Washougal Water Resource Inventory Area (WRIA) #28 WDFW - Salmonid Stock Inventory



Wa. Dept. of Ecology, GIS Technical Services 05/30/08

CHFA28

Salmon/Washougal Water Resource Inventory Area (WRIA) #28 WDFW - Salmonid Stock Inventory

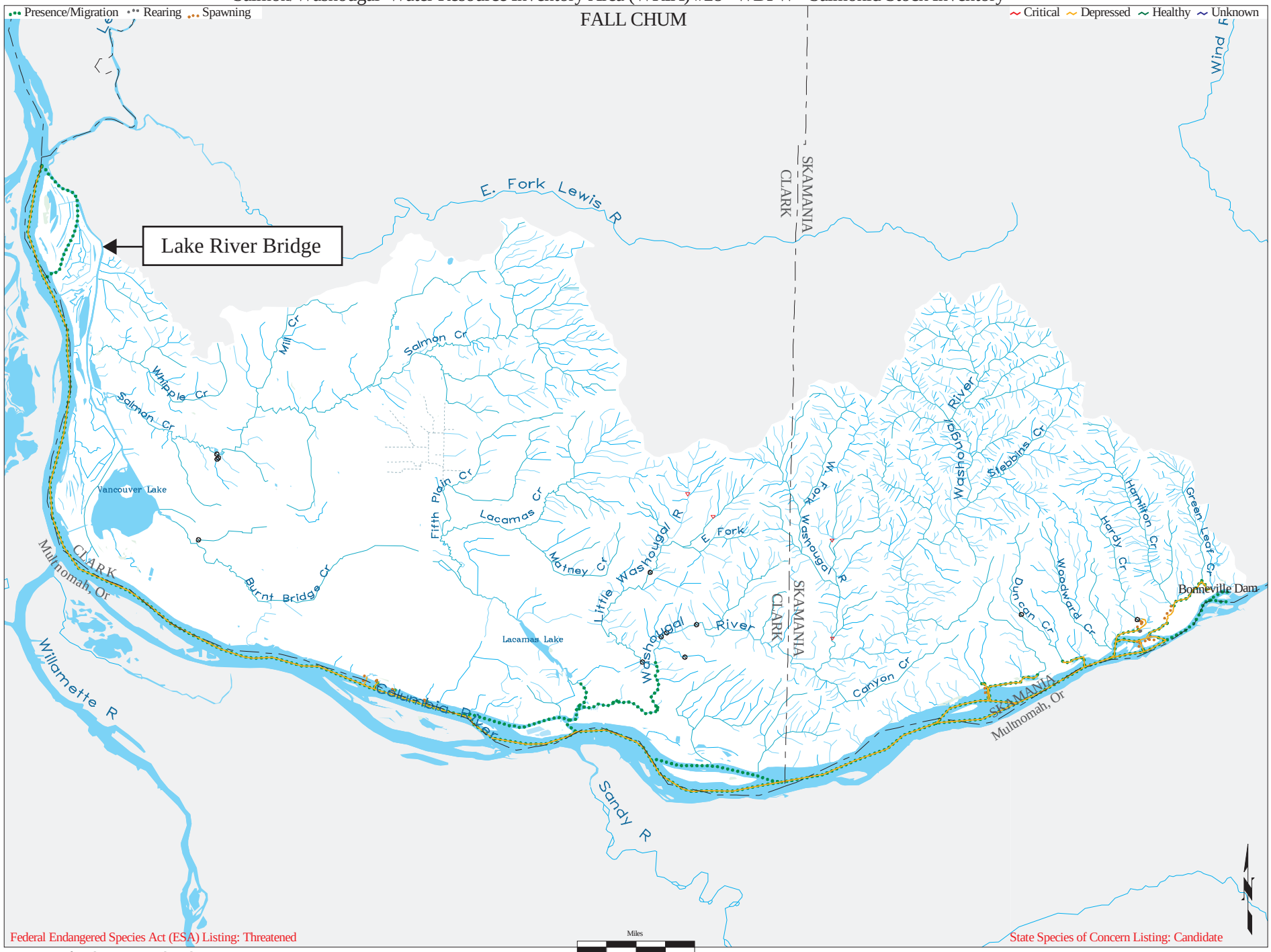


Wa. Dept. of Ecology, GIS Technical Services 05/30/08

SASI Status for this Species is Unknown/Unrated

CHSP28

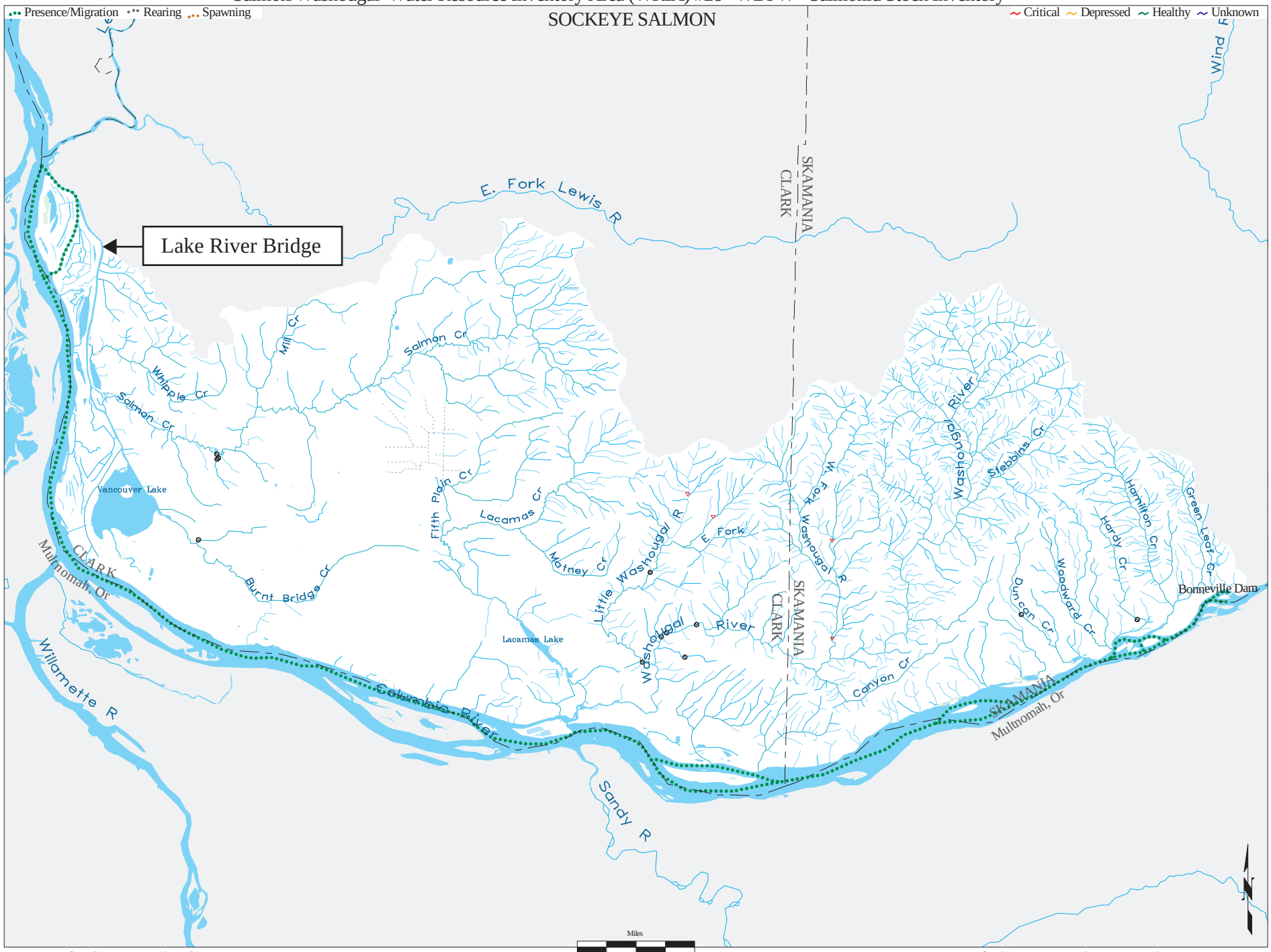
Salmon/Washougal Water Resource Inventory Area (WRIA) #28 WDFW - Salmonid Stock Inventory



Wa. Dept. of Ecology, GIS Technical Services 05/30/08

CHMF28

Salmon/Washougal Water Resource Inventory Area (WRIA) #28 WDFW - Salmonid Stock Inventory

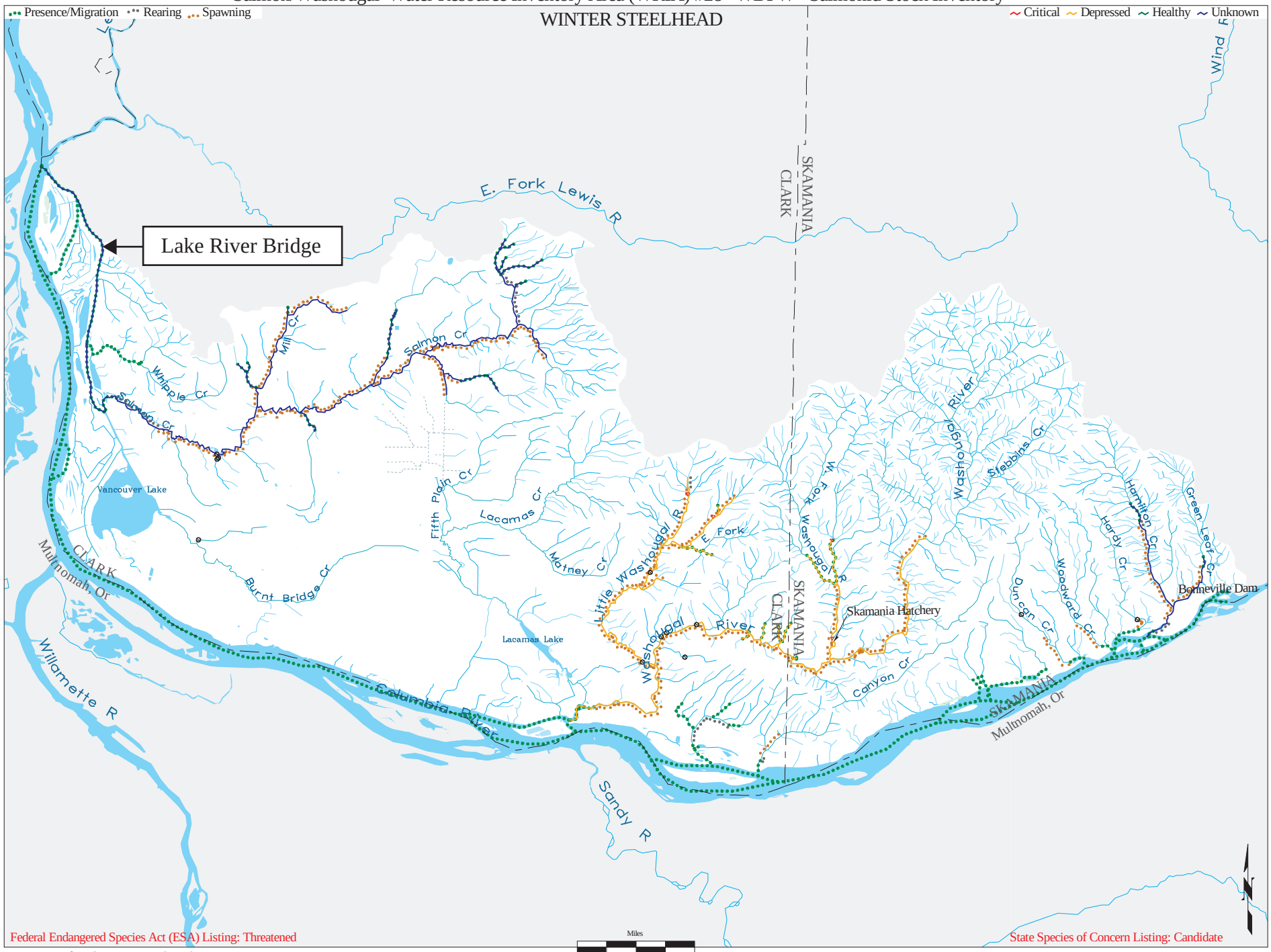


Wa. Dept. of Ecology, GIS Technical Services 05/30/08

SASI Status for this Species is Unknown/Unrated

SOCK28

Salmon/Washougal Water Resource Inventory Area (WRIA) #28 WDFW - Salmonid Stock Inventory



Wa. Dept. of Ecology, GIS Technical Services 05/30/08

STWI28

Appendix D: Site Photos

Photo number: 1 | **Direction:** NE

Description: Lake River bridge as seen from the refuge. Note opening for navigation channel.

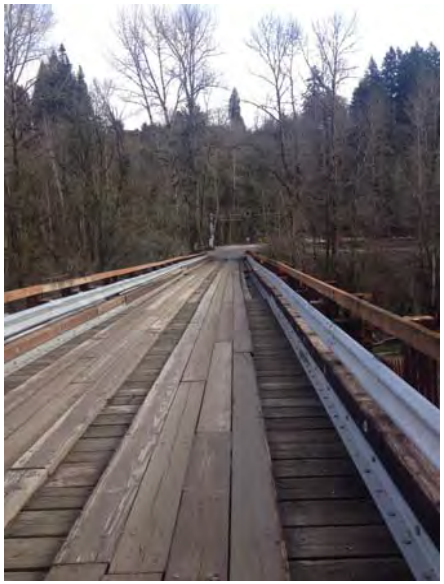


Photo number: 2 | **Direction:** E

Description: Timber decking of existing bridge.

Photo number: 3 | **Direction:** W

Description: Single lane access from east side of Lake River to refuge. Photo taken near railroad tracks.

Photo number: 4 | **Direction:** NE

Description: View of eastern shoreline where temporary work bridge will be used to construct new bridge directly upstream (to the right in this photo) of the existing bridge.

Photo number: 5 **Direction:** N

Description: Riparian vegetation along refuge side of the river.

Photo number: 6 **Direction:** S

Description: Lake River looking upstream from the bridge.

Photo number: 7 **Direction:** S

Description: Floodplain on refuge. USFWS manage this area as water fowl habitat.

Photo number: 8 **Direction:** SW

Description: Refuge area that will be used as staging area. Wetland area will be avoided. Note levee in the background.

Photo number: 9 | **Direction:** W

Description: View of refuge from bridge.

Photo number: 10 | **Direction:** SE

Description: Riparian vegetation along eastern shoreline near temporary work bridge location.

Photo number: 11 | **Direction:** NW

Description: Riparian vegetation along eastern shoreline that will be removed for permanent bridge and temporary work bridge.

Photo number: 12 | **Direction:** NE

Description: Unnamed intermittent tributary that drains into Lake River downstream of existing bridge. Confirmed as non-fish bearing.

Appendix E: Consultation History

From: stephen.morrow@dot.gov
To: Hutchinson, Matthew
Subject: FW: River S Bridge Replacement over Lake River
Date: Thursday, May 29, 2014 5:13:15 PM

Here's the other email string I was referring to…

Steve

From: Traffalis, Michael (FHWA)
Sent: Thursday, May 29, 2014 3:50 PM
To: MacDonald, Michael K.
Cc: Morrow, Stephen (FHWA); Collins, Brian (FHWA)
Subject: RE: River S Bridge Replacement over Lake River

Thanks Michael

We were planning on taking water samples quarterly, so we could easily take the water temp. Are there protocols for taking the temp?

From: MacDonald, Michael K. [mailto:MacDonM@wsdot.wa.gov]
Sent: Thursday, May 29, 2014 3:47 PM
To: Traffalis, Michael (FHWA)
Cc: Morrow, Stephen (FHWA); Collins, Brian (FHWA)
Subject: RE: River S Bridge Replacement over Lake River

Mike,
I checked with our underwater noise guru (Jim Laughlin) and it sounds like H-piles won't buy us much in decibel reduction vs using a bubble curtain on a hollow steel pile. Confined or unconfined bubble curtains would probably work equally well in Lake River due to the low velocity. Impact proofing one representative pile in a group is a good way to reduce the impacts.

Jim didn't think the oversized pile option would help reduce noise. CalTrans tried that method and it didn't reduce the decibel level because the noise traveled down the small pile, into the substrate, and back up into the outer pile where it then propagated into the water column. They also had troubles dewatering the outer pile. In short: it was fiddly and didn't work.

I've learned that Lake River is designated critical habitat for LC coho so we need to figure out the best timing to avoid/minimize listed species passing through the project action area. This will be complicated because of the BNRR.

Remind me what you said about gathering background info on turbidity. Are you also collecting water temperatures? If not, any chance to install a temp recorder (HOBO) under the bridge?

Clark Co replaced the Klineline Bridge and we have fish use information in Salmon Cr because of that project and I have a bit of info for Burnt Bridge but striking out so far about local fish timing in Lake River.

I'm checking with WSDOT projects to see other options might be considered.

Michael MacDonald
National Marine Fisheries Service Liaison
Shoreline Office 206-440-4909

From: Michael.Traffalis@dot.gov [mailto:Michael.Traffalis@dot.gov]
Sent: Thursday, May 29, 2014 12:27 PM
To: MacDonald, Michael K.
Cc: stephen.morrow@dot.gov; Brian.Collins@dot.gov
Subject: River S Bridge Replacement over Lake River

Michael

Thanks again for meeting us in the field yesterday. I have circled back with our geotechnical and structural engineer about the work bridge pile installation method. The work bridge is just our forecasted need that we plan to document in the BA and work through the permit process for, but in the end the contractor will be responsible for design and construction of the work bridge. That being said, we have estimated on the high side of the potential number of piles needed. But to give contractors the information they need to bid the project, besides a maximum number of temporary work bridge piles they also need to understand what is pile capacity is going to be or need to be.

In review of the mud profile across the channel, the mud is in excess of 200 feet deep, so relying solely on vibratory installation isn't going to work as we or the contractor has no way of knowing how much load can be placed on each pile.

So I need to understand better some the options we have, again at this time this is brainstorm to work with you to see what we can and can't do. Some potential other options are:

1. Install the round piles by vibratory methods, and conduct a strike confirmation. (Strike confirmation could range between 1 to 5 feet of additional driving. This would be based on the resistance encountered and obtaining the blow count to confirm the load capacity)
2. Only allow H piles. These again would follow the same installation method of the round piles, but H pile have a tendency to run so it may take longer length which would be more time working on each pile.
3. Install an oversize pipe around each pile and then drive the temporary work pile inside this casing. Example, require a 24" casing for each pile to driven inside of it.

Other option- are there fish presence studies or water temperature studies we can do to document no or minimal aquatic like. The Refuge biologist reported to us yesterday than typically by summer the water temperatures are high that don't support ESA fish. So can we work to ID parameter like, " install piles only when water temp is above XXX, or if below that do YYY to pile drive"

Just a lot of thinking out loud right now.

Thanks for your thoughts

Mike

From: stephen.morrow@dot.gov
To: Hutchinson, Matthew
Subject: FW: coho in Salmon Creek
Date: Thursday, June 12, 2014 1:46:15 PM

FYI...

-----Original Message-----
From: Friesz, Anne R (DFW) [mailto:Anne.Friesz@dfw.wa.gov]
Sent: Friday, June 06, 2014 10:52 AM
To: Morrow, Stephen (FHWA)
Subject: Re: coho in Salmon Creek

Hi Steve,
This is in regards to your question on whether or not coho are in Lake River and for that matter Salmon Creek.
When WDFW had a weir set up for two season, Nov 08 - May 10, they had a difficult time catching coho. The creek is really flashy and the high water would do something to the weir.
The creek has many outside influences helping with the coho population from the Lewis River Hatchery RSI boxes, to "Salmon in the Classroom" fish get dumped into there, and probably most successfully Dave Brown seines fish out, and rears them in his raceways and then returns them again as larger fish.
WDFW fish biologists have recently done surveys all in different areas in the upper reaches, upstream of Rock Creek and in their tributaries and they are finding redds.
The run timing encompasses the whole coho time frame of Oct 1 - Jan 31.
As for Lake River, it has always been thought of as a through-way.

I hope this answers your questions, let me know if you need anything else.

Anne Friesz | Assistant Regional Habitat Program Manager Washington Department of Fish and Wildlife | anne.friesz@dfw.wa.gov | cell: 360.600.1407

Hutchinson, Matthew

Subject: FW: Salmon Creek weir summary
Attachments: Salmon_Cr_weir_summary.xlsx

AMServiceURLStr: https://Slingshot.hdrinc.com:443/CFSS/control?view=services/FTService

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From: Grobelny, Julie A (DFW) [mailto:Julie.Grobelny@dfw.wa.gov]
Sent: Wednesday, July 09, 2014 12:05 PM
To: Morrow, Stephen (FHWA)
Subject: Salmon Creek weir summary

Hi Steve,

Here is a summary of what was caught in the Salmon Creek weir (RM 5.9) from late November 2008 to May 2010 when it was removed.

Let me know if you have any additional questions and have a great day,
Julie

Julie Grobelny
Washington Department of Fish and Wildlife
2108 Grand Boulevard
Vancouver, WA 98661
360.906.6719
360.906.6777 fax

Monthly Summary of Fish sampled at the Salmon Creek Weir (RM 5.9)

This is a summary of the fish caught in the live box of the weir.

This is not a population estimate of the fish entering Salmon Creek

Month / Year	# Coho sampled at the weir	# Steelhead sampled at the weir
November 20, 2008	trap installed	
November 2008	0	0
December 2008	0	0
January 2009	2	0
February 2009	0	0
March 2009	0	3
April 2009	0	0
May and June 2009	Trap not fishing	
July 2009	0	0
August 2009	0	0
September 2009	0	0
October 2009	8	2
November 2009	5	1
December 2009	3	5
January 2010	2	11
February 2010	0	14
March 2010	0	1
April 2010	0	0
May 2010	trap removed	

Trap Notes

trap was not installed until November 20, 2008

Lost the live box to the trap in the high water event of January 2009

Live box was reinstalled mid January 2009

in general 2008 was not a good return year for coho throughout the lower Columbia

Salmon Creek is predominately a late coho stream with winter steelhead.

There were a few summer steelhead sampled early on in the season, but the run was predominately winters
it is stocked with late coho eggs from Lewis River Hatchery in RSI boxes placed throughout the upper basin
a lot of salmon in the classroom fish are also deposited into Salmon Creek
it is stocked with winter steelhead smolts from Skamania Hatchery. They are placed in Klineline Pond for acclimation and then r

Hutchinson, Matthew

Subject: RE: Survey Data for Salmon Creek (Clark County)

AMServiceURLStr: https://Slingshot.hdrinc.com:443/CFSS/control?view=services/FTService

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From: Brown, Lisa R (DFW) [mailto:Lisa.Brown@dfw.wa.gov]
Sent: Tuesday, July 22, 2014 10:28 AM
To: Morrow, Stephen (FHWA)
Cc: Gray, Steven W (DFW); Buehrens, Thomas W (DFW)
Subject: FW: Survey Data for Salmon Creek (Clark County)

Hi Stephen,

I have attached a file of all of the surveys we have done in the Salmon Creek basin since 1944 for all species. The file was for all of WRIA 28, but I deleted all of the creeks in the Washougal basin and the Lower Gorge tribs. The first attachment goes through 2012 run year. Our 2013 data has not been uploaded to our SGS database yet, so the other zip file is an access database and includes Salmon Creek basin, Washougal basin, and Lower Gorge tribs. I do not have a copy of any finalized reports for this yet. We have been using a GRTS (Generalized Random Tessilation Stratification) design for coho surveys in Salmon Creek basin since 2011 (basically a rotating panel of randomly selected points). Please let me know if you have any questions. I will be in the office today and tomorrow and back in the field on Thursday.

Thank you,

Lisa Brown
Fish Biologist
ESA/Anadromous Fish Unit
WDFW Region 5
2108 Grand Blvd.
Vancouver, WA 98661
office 360-906-6769
cell phone 360-704-0206
lisa.brown@dfw.wa.gov

From: Gray, Steven W (DFW)
Sent: Monday, July 21, 2014 8:32 AM
To: Brown, Lisa R (DFW)
Subject: FW: Survey Data for Salmon Creek (Clark County)

Lisa,
Can you see what information you can provide for the request below?

Thanks

swg

Steven W Gray
Wa. State Fish & Wildlife
F&W Biologist 3
2108 Grand Blvd
Vancouver, Wa 98661
360.904.8652 mobile
360.906.6726 office
360.906.6776 fax
steven.gray@dfw.wa.gov

From: stephen.morrow@dot.gov [mailto:stephen.morrow@dot.gov]
Sent: Wednesday, July 09, 2014 3:01 PM
To: Gray, Steven W (DFW)
Subject: Survey Data for Salmon Creek (Clark County)

Hello Steve:

I have been communicating with Julie Grobelny in your office regarding survey data in Salmon Creek and understand you have had some crews conducting spawning surveys and other fish surveys in Salmon Creek the last couple years. I am interested in any data or reports you may have on the timing & species from your surveys. I am working on an ESA consultation for a bridge replacement over Lake River and am trying to determine timing when fish would likely be present/passing through on their way upriver to Salmon Creek, Burnt Bridge Creek and the other tributaries. Thank you in advance for any info you have.

Steve Morrow
Environmental Protection Specialist
FHWA (Western Federal Lands)
610 E 5th Street
Vancouver, WA 98661
(360) 619-7811
stephen.morrow@dot.us

From:	stephen.morrow@dot.gov
To:	Hutchinson, Matthew
Subject:	FW: Message from KMBT_C552
Date:	Wednesday, June 18, 2014 11:16:25 AM
Attachments:	SKMBT_C55214061810360.pdf

From: Byrne, James B (DFW) [mailto:James.Byrne@dfw.wa.gov]
Sent: Wednesday, June 18, 2014 10:47 AM
To: Morrow, Stephen (FHWA)
Cc: Weinheimer, John (DFW)
Subject: FW: Message from KMBT_C552

Steve,

Attached is the relevant fish data from the 1986 inventory. They detected no salmonids. Either they were not there, or the mesh in their gill nets was too large. Zero is a valid data point. Perhaps Julie Grobelney or the USF&WS Ridgefield Refuge will be able to provide additional information.

Jim

From: DFW5HQL552A@dfw.wa.gov [mailto:DFW5HQL552A@dfw.wa.gov]
Sent: Wednesday, June 18, 2014 10:38 AM
To: Byrne, James B (DFW)
Subject: Message from KMBT_C552

HABITAT INVENTORY AND EVALUATION OF THE VANCOUVER LAKE / COLUMBIA RIVER LOWLANDS

FINAL REPORT

PREPARED BY

envirosphere company
BELLEVUE, WASHINGTON

PROJECT MANAGER
John J. Brueggeman

CONTRIBUTORS
David Every
John Knutzen

PREPARED FOR
Port of Vancouver
Vancouver, Washington

FEBRUARY 1986

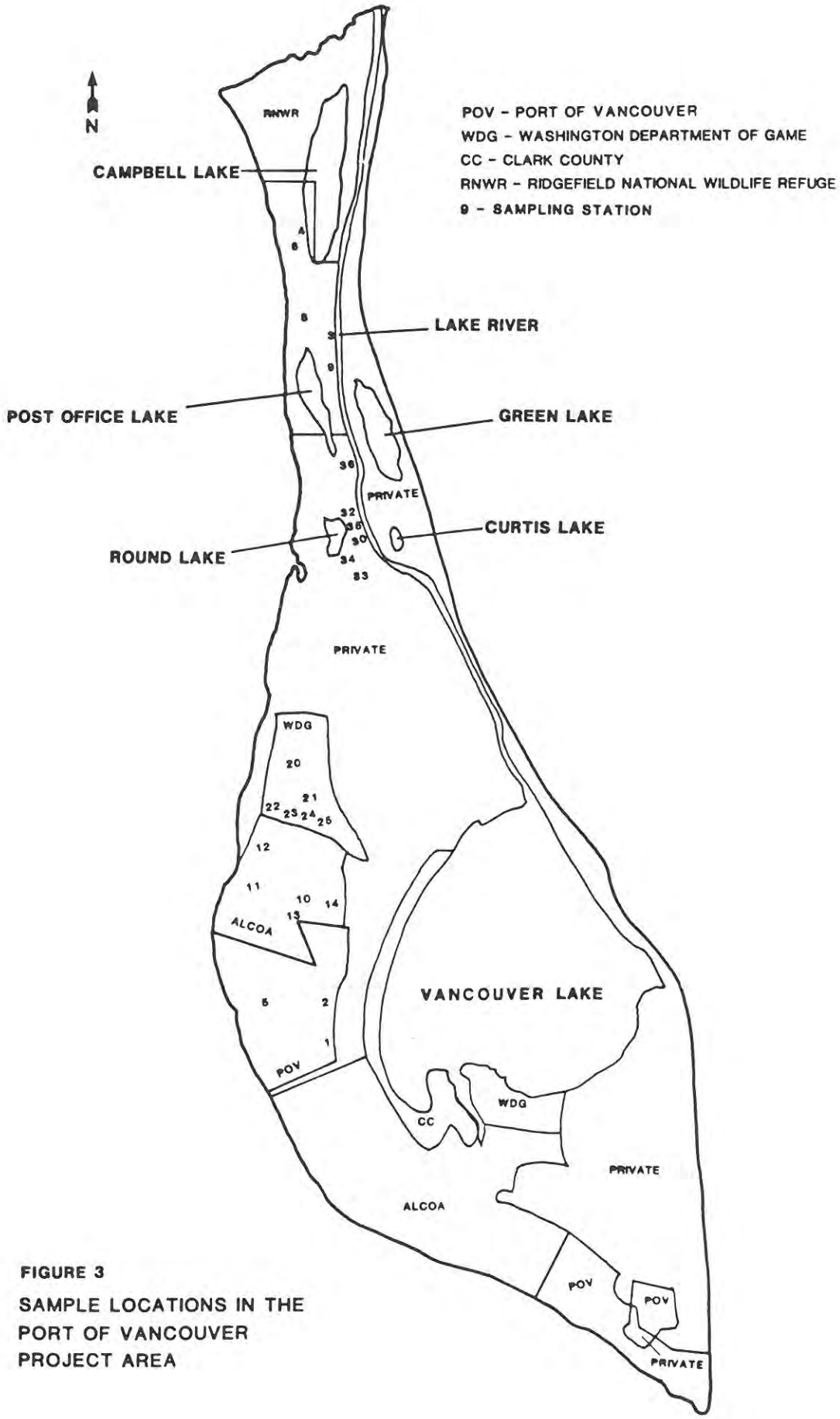

FIGURE 3

SAMPLE LOCATIONS IN THE PORT OF VANCOUVER PROJECT AREA

TABLE 11

BEACH SEINE CATCHES (NO. PER 1,000 m^2) OF FISH
IN SELECTED WATERBODIES OF PORT OF VANCOUVER PROJECT AREA
MARCH, 1985[a]

Species	Buckmire Slough	Post Office Lake	Campbell Lake	Vancouver[b] Lake
White Crappie	159.7	12.5	--	21.1
White Crappie[c]	41.6	11.3	0.6	--
Carp	32.4	20.1	--	13.7
Carp[c]	33.9	24.9	2.3	--
Black Crappie	29.5	53.9	--	24.4
Black Crappie[c]	4.1	37.0	2.4	--
Blue Gill	27.3	1.9	--	1.5
Blue Gill[c]	2.5	--	--	--
Largemouth Bass	2.1	3.0	--	21.8
Largemouth Bass[c]	4.1	0.4	43.0	--
Warmouth	5.9	--	--	0.3
Yellow Perch	2.4	86.0	--	11.6
Yellow Perch[c]	1.8	184.7	--	--
Pumpkinseed	1.8	--	--	0.4
Brown Bullhead	1.0	11.8	--	0.2
Mosquitofish	1.1	0.5	8.4	--
Yellow Bullhead	0.6	0.8	--	--
Goldfish	0.7	3.4	--	1.5
Threespine Stickleback	--	--	6.9	0.6
Northern Squawfish[c]	--	--	1.9	0.2
Largescale Sucker	--	--	--	0.1
Walleye	--	--	--	0.1
Prickly Scaupin	--	--	--	0.3
Peamouth	--	--	--	0.2
American Shad	--	--	--	9.6
Total	352.6	451.9	65.4	107.5

a/ See Appendix Tables B-2, 3, 4, 5 for detailed presentation.
b/ Results of September 1982, October 1983, and September 1984 average beach seine catch.
c/ Underyearlings.

TABLE 12

HABITAT SUITABILITY INDICES (HSIs), AVAILABLE HABITAT AREA (ACRES), AND HABITAT UNITS (HUs) FOR FISH IN SELECTED WATERBODIES AND THE TOTAL AREA OF THE PORT OF VANCOUVER PROJECT AREA 1/

	Surveyed Waterbodies					Unsurveyed Waterbodies 2/				
	Vancouver Lake	Campbell Lake	Lake River	Buckmire Slough	Post Office Lake	Green Lake	Flushing Channel	Round Lake	Curtis Lake	All Waterbodies
Largemouth Bass										
HSI	0.63	0.54	0.25	0.58	0.60	0.59	0.25	0.59	0.59	0.59
Area	2254	209	198	85	62	110	25	13	10	2966
Hu	1420	113	50	49	37	65	6	7	6	1753
Black Crappie										
HSI	0.86	0.72	0.41	0.72	0.39	0.67	0.41	0.67	0.67	.79
Area	2254	209	198	85	62	110	25	13	10	2966
Hu	1938	150	81	61	24	74	10	9	7	2354
Brown Bullhead										
HSI	0.73	0.76	0.31	0.81	0.73	0.76	0.31	0.76	0.76	0.70
Area	2254	209	198	85	62	110	25	13	10	2966
Hu	1645	159	61	69	45	84	8	10	7	2088
Carp										
HSI	0.81	0.73	0.56	0.64	0.76	0.74	0.56	0.74	0.74	.78
Area	2254	209	198	85	62	110	25	13	10	2966
Hu	1826	153	111	54	47	81	14	10	7	2303
Yellow Perch										
HSI	0.40	0.32	0.24	0.46	0.20	0.34	0.24	0.34	0.34	.38
Area	2254	209	198	85	62	110	25	13	10	2966
Hu	902	67	48	39	12	37	6	4	3	1118

1/ Values used to calculate HSIs and HUs are provided in Appendix B on HEP forms.
2/ Flushing channel HSIs assumed the same as Lake River. Others assumed to be the average HSIs of the surveyed non-river waterbodies.

0943a

TABLE 13

DENSITY (NUMBER/1000M^2) AND HSIs OF FISH EVALUATION SPECIES BY WATER BODY IN PORT OF VANCOUVER PROJECT AREA

Species	WATERBODIES									
	Vancouver Lake[a/]		Post Office Lake		Campbell Lake		Buckmire Slough		Lake River	
	Density	HSI	Density	HSI	Density	HSI	Density	HSI	Density	HSI
Largemouth Bass	b/		3.0		0		2.1		N/S[c/]	
Largemouth Bass[d/]	b/		0.4		43.0		4.1		N/S	
Total	21.8	0.63	3.4	0.54	43.0	0.60	6.2	0.58	N/S	0.25
Black Crappie	b/		53.9		0		29.5		N/S	
Black Crappie [d/]	b/		37.0		2.4		4.1		N/S	
Total	24.4	0.86	90.9	0.39	2.4	0.72	33.6	0.72	N/S	0.41
Carp	b/		20.1		0		32.4		N/S	
Carp [d/]	b/		24.9		2.3		33.9		N/S	
Total	13.7	0.81	45.0	0.76	2.3	0.73	66.3	0.64	N/S	0.56
Brown Bullhead	b/		11.8		0		1.0		N/S	
Brown Bullhead[d/]	b/		0		0		0		N/S	
Total	0.2	0.73	11.8	0.73	0	0.76	1.0	0.81	N/S	0.31
Yellow Perch	b/		86.0		0		2.4		N/S	
Yellow Perch[d/]	b/		184.7		0		1.8		N/S	
Total	11.6	0.40	270.7	0.20	0	0.32	4.2	0.46	N/S	0.24

a/ Average values taken from data for September 1982, October 1983, and September 1984 beach seine catches (Knutzen and Cardwell, 1984).
b/ Age not determined.
c/ NS = Not sampled.
d/ Underyearling. All others of same species older.

0943a

From:	stephen.morrow@dot.gov
To:	Hutchinson, Matthew
Subject:	FW: Vancouver Lake Results
Date:	Thursday, June 19, 2014 10:08:49 AM
Attachments:	2009 Vanc Lake Blue-Green algae.pdf 2010 Vancouver Lake E.Coli.pdf 2011 E.Coli.pdf 2012 E Coli.pdf 2013 Vancouver Lake.pdf Vancouver Lake E.Coli 2008.pdf Vancouver lake E.coli 2006.pdf Vancouver Lake E.Coli 2007.pdf

---

Water quality data for Vancouver Lake. Not Lake River, but proximate data and also water flows back & forth between Vancouver Lake & Lake River.

-----Original Message-----
From: Webster, Christine [mailto:Christine.Webster@clark.wa.gov]
Sent: Wednesday, June 18, 2014 4:58 PM
To: Morrow, Stephen (FHWA)
Subject: Vancouver Lake Results

Hello Stephen,
Here are the results from 2006-2013. Please let me know if this is what you were looking for or if I can help with anything else.

Thank you!

Christine Webster | Environmental Health Specialist Clark County Public Health
Phone: (360) 397-8428 x7275
Web | Facebook | Twitter

Public Health: Always working for a safer and healthier community.

NOTE: To meet with staff - appointments are strongly encouraged.

This e-mail and related attachments and any response may be subject to public disclosure under state law.

VANCOUVER LAKE CYANOBACTERIA RESULTS 2009

(Blue-green algae)

Cell Density (Number of cells per ml.) composite sample

Sample Date:		**07/21/09**	**07/27/09**	**08/03/09**	**08/10/09**	**08/17/09**	**08/24/09**	**09/08/09**
TAXA								
Aphanizomenon		23,872	32,935	69,669	131,860	209,853	383,687	712,105
Anabaena		138,769	516,276	393,784	212,696	86,979	25,916	27,297
Microcystis		0	0	0	0	0	0	0
Oscillatoria		0	0	0	0	0	0	0
Other								
Toxin Levels	Mycrocystin:	<..05µg/L	0.0975µg/L	0.274µg/L	16.4µg/L	0.41µg/L	0.42µg/L	0.21µg/L
	Anatoxin-a:	<.038µg/L	0.04µg/L	<.15µg/L	0.53µg/L	0.04µg/L	0.06µg/L	<0.04µg/L
CONDITIONS								
Temperature			27.4	26	24	20.7	21.8	18.5
DO			17.3	11.3	15.8	10.3	10.4	7.1
Percent DO			206	115	187	88	119	75
Conductivity			160	130	133	122	126	126
Turbidity			72.7	56	91.7	67	50	68
pH			10.5	9.2	9.9	8.7	9.4	8.6
Tide		low	low	very low	very low	lowest this year	very low	very low
Weather		sunny	sunny	sunny	sunny	sunny	sunny	ptly cloudy
Wind		light	light	calm	moderate	moderate	very light	very light
Scum?		yes	yes	yes	yes	no	no	no

*** The standard for closing the swimming area is: microcystin : 6µg/L ; anatoxin-a : 1µg/L**

Clark County Public Health Department
Environmental Public Health

VANCOUVER LAKE E.COLI MONITORING RESULTS - 2010

		24-May	7-Jun	21-Jun	6-Jul	19-Jul	3-Aug	16-Aug	30-Aug
Temperature ˚C		15.6	18.3	20.8	20.3	20.4	21	24.3	18.7
DO		11.3		7.8	8.4	7.9	6.4	6.6	8.3
Percent DO		113		90	94.3	88.6	75.1	74.5	85.6
Conductivity (µS)		163		140	131	132	134.2	145.6	135.1
Turbidity (NTU)		15	4	5.8	39.2	56.7	95.8	27.1	43.1
pH		7.9	7	7.9	7.7	8	9.2	8.9	8.1
E-coli	**Location**								
	VAN063	2	2	1	7.4	7.4	7.4	27.5	1
	VAN064	4.1	2	0	4.1	1	6.3	22.8	4.1
	VAN065	4.1	12.2	13.4	8.4	3.1	3	31.8	7.4
	Duplicate	3.1	27.2	13.4	5.2	0	2	14.6	3
	VAN066	5.1	9.6	3.1	8.6	1	11	14.6	3
	VAN067	8.5	18.5	1	5.2	1	7.4	19.3	3

NOTE: The EPA recommended level for closing a beach is 236.

	Weather conditions/notes							
	cloudy	m.cloudy	p.cloudy	sunny	cloudy	cloudy	sunny	cloudy
air temp	55 f	65 f	70f	75f	65f			
water level	very high	highest ever	medium	low/med	low	low	v.low	v low
birds	none	10 gulls	25 gulls @065	16gulls	15	26 gulls	30 gulls	13 gulls
wind	light	calm	light	light	light	light	calm	light

VANCOUVER LAKE E.COLI MONITORING RESULTS - 2011

		23-May	6-Jun	20-Jun	11-Jul	25-Jul	8-Aug	22-Aug
Temperature ˚C		16		20.1	21.8	22	21.4	
DO		10.3		7.9	9.4	7.3	8.2	
Percent DO		96		87	106	87	95	
Conductivity (µS)		153		157	153	160	164	
Turbidity (NTU)		2.9		4.7	6.3	16.4	20.5	
pH		8.1		7.8	8.2	7.5	7.9	
E-coli	Location							
	VAN063	4.1	12.1	2	5	8.4	12.1	8.4
	VAN064	14.5	14.5	1	1	9.8	9.7	7.3
	VAN065	4.1	10.8	1	5	7.4	9.6	7.4
	Duplicate	5.2	8.6	1	1	7.4	4.1	6.2
	VAN066	4.1	8.5	1	3	6.3	6.3	5.2
	VAN067	5.2	6.3	0	4	10.9	8.5	12.2

NOTE: The EPA recommended level for closing a beach is 236.

Weather conditions/notes							
	cloudy	cloudy	p.cloudy	m.cloudy	cloudy	cloudy	cloudy
air temp	55 f	60f	63	68	69	67	68
tide (Columbia R.@ Vanc)	15.6 ft	17.2 ft	15 ft	11.0 ft	6.5 ft	4.0 ft	2.7
birds	none	none	none	10 gulls	60 gulls	85 gulls	15 gulls
wind	v. light	v. light	light	v.light	v. light	light	light

VANCOUVER LAKE E.COLI MONITORING RESULTS - 2012

		21-May	4-Jun	20-Jun	2-Jul	5-Jul	18-Jul	30-Jul	13-Aug
Temperature ˚C				19.2				23.8	
DO (mg/L)				7.8				8.75	
Percent DO				81.8				104	
Conductivity (µS)				136.2				141.2	
Turbidity (NTU)				NA				25.8	
pH				7.8				8.58	
E-coli	**Location**								
	VAN063	7.4	14	178.5	20	6.3	57	31	
	VAN064	4.1	22	43.7	36	8.5	93	32	
	VAN065	9.5	29	23.8	34	6.3	88	54	
	Duplicate	12	31	30.9	27	3.1	56	31	
	VAN066	4.1	8.6	40.2	34	18	59	56	
	VAN067	2	3.1	122.3	1,200	15	110	34	

NOTE: The EPA recommended level for closing a beach is 236.

	Weather conditions/notes				
	rain	cloudy	sunny	overcast	sunny
air temp	55 F	58 F	63 F	66 F	72 F
water level	11.3 ft	9.2 ft	10.8 ft	9.39 ft	6.8 ft.
birds	none	none	none	geese	none
wind	moderate	calm	calm	calm	calm

Vancouver Lake E-Coli Monitoring Results 2013

	6-Jun	18-Jun	2-Jul	16-Jul	30-Jul	13-Aug	27-Aug	10-Sep
					3pm sample			
Temperature C°		20.6	25.6	23.1	28	24.4	24.7	
DO		9.09	8.4	8.61	11.82	12.49	6.51	
Percent DO		101.4	103.9	97.6	155.2	148.9	59.2	
Conductivity (µS)		145.7	144.9	139	145.6	143.9	106.4	
Turbidity (NTU)		28.8	18.5	49.1	62.6	38.2	out of range	
pH		9.23	9.46	9.26	9.3	9.71	9.5	

E-Coli Sample Sites

VANL63	12.2/100ml*	13.2/100ml*	88.2/100ml	42.6/100ml	15.8/100ml	<1/100ml*	<1/100ml	4.1/100ml*
VANL64	4.1/100ml	16.1/100ml	39.5/100ml	53.0/100ml	8.6/100ml	30.9/100ml	<1/100ml*	<1/100ml
VANL65	3.1/100ml	12/100ml	48.7/100ml*	26.5/100ml	7.3/100ml	5.2/100ml	<1/110ml	12.1/100ml
VANL66	4.1/100ml	18.5/100ml	47.1/100ml	29.5/100ml	18.7/100ml	23.8/100ml	101/100ml	4.1/100ml*
VANL67	2/100ml	18.3/100ml	99/100ml	28.8/100ml*	1.0/100ml	1.0/100ml	70/100ml	<1/100ml
Duplicate	8.5/100ml	13.4/100ml	60.1/100ml	31.7/100ml	8.5/100ml	1.0/100ml	**2419/100ml**	4.1/100ml

NOTE: The EPA recommended level for closing a beach is 23 * = duplicate was sampled from that site

Vancouver Lake Cyanobacteria Results 2013

Cell density (number of cells per ml.) composite sample

Sample Date: July 30th

TAXA
Aphanizomenon
Anabaena
Microcystis
Oscillatoria
Other

Toxin Levels: **Mycrocystin:MDL 0.16 ug/l** 0.2
Anatoxin-a :MDL 1.01 ug/L <MDL

* The standard for closing the swimming area is: microcystin : 6µg/L ; anatoxin-a : 1µg/L

VANCOUVER LAKE E-COLI MONITORING RESULTS - 2008

		19-May	2-Jun	16-Jun	7-Jul	14-Jul	28-Jul	11-Aug	25-Aug	8-Sep
Temperature ˚C		21.3	16.6	17	21.8	24.4	23.2	N/A	21.6	19.7
DO		9.8	9.3	8.7	9.6	9.5	N/A	N/A	11.8	7.3
Percent DO		111	95	90.7	110	105	N/A	N/A	128	80.9
Conductivity (µS)		151	140	113	139	140	N/A	N/A	131	131
Turbidity (NTU)		4.02	3.4	10.7	30.6	35.8	35.7	N/A	58.3	125
pH		8.6	7.7	8.1	8.1	8.9	9.7	N/A	8.9	7.5
Air Temp ˚C		23.9	12.7	11.1	21.8	21.1	22.8	20	17.5	18.1
E-coli	**Location**									
	VAN063	5.2	8.6	7.4	7.3	49.5	30.1	14.3	7.4	2
	VAN064	6.3	8.6	6.3	6.3	35.9	2	19.7	17.3	2
	VAN065	6.3	30.5	5.2	3.1	34.5	13.4	5.2	16.1	2
	Duplicate	5.2	26.2	3.1	3.1	51.2	17.1	5.2	19.9	3.1
	VAN066	3.1	3.1	7.4	6.3	54.6	18.1	12.8	52.8	ND
	VAN067	8.5	13.5	4.1	8.5	48.1	8.4	9.7	77.6	2

NOTE: The EPA recommended level for closing a beach is 236.

VANCOUVER LAKE E-COLI MONITORING RESULTS - 2006

		22-May	5-Jun	26-Jun	10-Jul	17-Jul	18-Jul	24-Jul	27-Jul	7-Aug	8-Aug	28-Aug	11-Sep
Temperature ˚C		19.5	19.5	23.3	23			27.5		23.4		23.5	20.3
DO		10.1	9.3	8.5	8			10.3		9.9		11	9.9
Percent DO		109.8	105.8	101.7	82.8			129.7		116.9		128.8	110
Conductivity (µS)		165.4	159	159	159			161.8		156.7		151	149
Turbidity (NTU)		4.6	11.5	15.6	28.4			12.8		22.4		18.3	54.5
Ph		8.2	8.15	8.45	8			9.3		9.4		9.8	8.9
Air temp °F			72	81	71			86		68		73	66
E-coli	**Location**												
	VAN063	2	13.2	2	387	7.4	5.2	17.1	78.9	291	0	0	7.4
	VAN064	12.1	5.2	0	365	3	2	1	37.3	206	0	0	6.3
	VAN065	9.8	7.4	0	276	9.8	2	172	33.2	120	9.7	1	13.5
	Duplicate	5.2	3	0	240	2	3.1	66.3	48	122	8.6	0	9.7
	VAN066	5.2	0	2	115	3.1	3.1	727	38.4	167	2	2	5.2
	VAN067	8.3	8.6	0	55.6	5.2	3	30.1	18.5	115	1	3.1	5.2

NOTE: The EPA recommended level for closing a beach is 236.
NOTE: Many seagulls on the beach and in water near Van-066 on July 24 and Aug 7. ~100 near 065 and 066 on Aug 28. ~75 on Sept. 11

Hutchinson, Matthew

Subject: FW: Contact EIM (EIMGeneral) Comment from stephen.morrow@dot.gov
Attachments: LakeRivTemps.xlsx

AMServiceURLStr: https://Slingshot.hdrinc.com:443/CFSS/control?view=services/FTService

From: Coots, Randy (ECY) [mailto:rcoo461@ECY.WA.GOV]
Sent: Thursday, June 19, 2014 8:45 AM
To: Morrow, Stephen (FHWA)
Subject: RE: Contact EIM (EIMGeneral) Comment from stephen.morrow@dot.gov

Hey Steve,
I do have spring and fall 2010 temperature data for Lake River North at McCuddy's Marina and Lake River South at Filida Moorage. There's about a month of temperature measurements collected every 2 minutes by TidBit data loggers. The data is cut for my purposes to about a month that my SPMDs were deployed but all in each file is continuous. I didn't need or collect DO and I don't know of any that's out there. Let me know if you have any questions.
Randy

Randy Coots
Department of Ecology
Environmental Assessments Program, Toxics Studies Unit
300 Desmond Drive
P.O. Box 47710
Olympia, WA 98504-7710
Phone: (360) 407-6690
Fax: (360) 407-6884
Email: rcoo461@ecy.wa.gov

From: stephen.morrow@dot.gov [mailto:stephen.morrow@dot.gov]
Sent: Wednesday, June 18, 2014 4:07 PM
To: Coots, Randy (ECY)
Subject: FW: Contact EIM (EIMGeneral) Comment from stephen.morrow@dot.gov

Hello Randy:

I am contacting you in hopes you may have information I am interested in. In the report you authored "PCB, Dioxin, and Chlorinated Pesticide Sources to Vancouver Lake" – I am interested in water quality data for Lake River. Appendix E has WQ data for TSS & TOC. I am interested in learning if you also have the data for temperature and DO; specifically at the two sampling locations on Lake River? Thank you for any info you can provide.

Steve Morrow
Environmental Protection Specialist
FHWA (Western Federal Lands)
610 E 5th Street
Vancouver, WA 98661
(360) 619-7811
stephen.morrow@dot.us

From: Neumiller, Chris (ECY) [mailto:cneu461@ECY.WA.GOV]
Sent: Wednesday, June 18, 2014 3:45 PM
To: Morrow, Stephen (FHWA)
Subject: RE: Contact EIM (EIMGeneral) Comment from stephen.morrow@dot.gov

Hi Steve

This data from this study is not yet in EIM. You might want to contact the study lead, Randy Coots, at Randy.Coots@ecy.wa.gov if you need the data now.

The report is available via our online publications: https://fortress.wa.gov/ecy/publications/summarypages/1103063.html

Chris

CHRISTINE NEUMILLER L.HG.
Geospatial and Environmental Systems
WA Department of Ecology, Olympia | (360) 407-6258
chris.neumiller@ecy.wa.gov | www.ecy.wa.gov/eim

From: EIMSystem@ecy.wa.gov [mailto:EIMSystem@ecy.wa.gov]
Sent: Wednesday, June 18, 2014 2:27 PM
To: Neumiller, Chris (ECY); Carmack, Kristin (ECY); Erickson, Rachael (ECY)
Subject: Contact EIM (EIMGeneral) Comment from stephen.morrow@dot.gov

Request for more information on EIMGeneral.

Email Address : stephen.morrow@dot.gov

User Name : Steve Morrow

Category : EIMGeneral

Comment(s) : Report "PCB, Dioxin, and Chlorinated Pesticide Sources to Vancouver Lake" Cannot access. Interested in obtaining the WQ Monitoring Results, esp. for the 2 Lake River sampling loctions

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ridgefield National Wildlife Refuge Complex
PO Box 457
28908 NW Main Avenue
Ridgefield, WA 98642
(360) 887-4106 FAX (360) 887-4109

December 17, 2012

The Chinook Indian Nation
Attn: Ray Gardner, Tribal Chairman
P.O. Box 368
Bay Center, WA 98527

Dear Mr. Gardner:

The purpose of this letter is to provide you and/or members from your staff an update of the progress with the River 'S' Unit Access Study.

The U.S. Fish and Wildlife Service along with Federal Highway Administration have developed a selected range of alternatives to the River 'S' Unit of the Refuge. These alternatives have gone through a screening process to narrow down viable alternatives with the preferred alternative being the existing access route with two subset versions of improvements. The identification and selection of alternatives were made based on the following objectives: 1) improve the reliability and mobility of public access to and from the River 'S' Unit, 2) improve the USFWS's ability to efficiently carry out operations consistent with its management goals within the Ridgefield Refuge Complex, and 3) provide for a transportation solution that is sustainable for the resources on the Refuge and in the community of Ridgefield.

A public meeting on the range of alternatives and the screening process we went through will be held in January 2013. We recognize the Chinook community as a significant stakeholder and partner and wish to provide your tribal government an opportunity to provide comments and voice any concerns regarding where we are in this process. You may contact me directly to discuss this project.

We value and appreciate your past involvement with programs of the Refuge. Thank you for your interest in management of the Ridgefield National Wildlife Refuge.

Sincerely,

Christopher Lapp
Refuge Manager

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ridgefield National Wildlife Refuge Complex
PO Box 457
28908 NW Main Avenue
Ridgefield, WA 98642
(360) 887-4106 FAX (360) 887-4109

December 17, 2012

The Cowlitz Indian Tribe
Attn: William B.Iyall, Tribal Chairman
1055 9th Avenue Suite B
Longview, WA 98632

Dear Mr. Iyall:

The purpose of this letter is to provide you and/or members from your staff an update of the progress with the River 'S' Unit Access Study.

The U.S. Fish and Wildlife Service along with Federal Highway Administration have developed a selected range of alternatives to the River 'S' Unit of the Refuge. These alternatives have gone through a screening process to narrow down viable alternatives with the preferred alternative being the existing access route with two subset versions of improvements. The identification and selection of alternatives were made based on the following objectives: 1) improve the reliability and mobility of public access to and from the River 'S' Unit, 2) improve the USFWS's ability to efficiently carry out operations consistent with its management goals within the Ridgefield Refuge Complex, and 3) provide for a transportation solution that is sustainable for the resources on the Refuge and in the community of Ridgefield.

A public meeting on the range of alternatives and the screening process we went through will be held in January 2013. We recognize the Cowlitz community as an independent nation, significant stakeholder, and partner. I would like to provide your tribal government an opportunity to provide comments and voice any concerns regarding where we are in this process. You may contact me directly to discuss this project.

We value and appreciate your past involvement with programs of the Refuge. Thank you for your interest in management of the Ridgefield National Wildlife Refuge.

Sincerely,

Christopher Lapp
Refuge Manager

United States Department of the Interior

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December 17, 2012

The Confederated Tribes of the Grande Ronde Community of Oregon
Attn: Cheryle A. Kennedy, Tribal chairwoman
9615 Grande Ronde Road
Grande Ronde, Oregon 97347

Dear Mrs. Kennedy:

The purpose of this letter is to provide you and/or members from your staff an update of the progress with the River 'S' Unit Access Study.

The U.S. Fish and Wildlife Service along with Federal Highway Administration have developed a selected range of alternatives to the River 'S' Unit of the Refuge. These alternatives have gone through a screening process to narrow down viable alternatives with the preferred alternative being the existing access route with two subset versions of improvements. The identification and selection of alternatives were made based on the following objectives: 1) improve the reliability and mobility of public access to and from the River 'S' Unit, 2) improve the USFWS's ability to efficiently carry out operations consistent with its management goals within the Ridgefield Refuge Complex, and 3) provide for a transportation solution that is sustainable for the resources on the Refuge and in the community of Ridgefield.

A public meeting on the range of alternatives and the screening process we went through will be held in January 2013. We recognize the Grande Ronde community as an independent nation and would like to provide your tribal government an opportunity to provide comments and voice any concerns regarding where we are in this process. You may contact me directly to discuss this project.

We value and appreciate your past involvement with programs of the Refuge. Thank you for your interest in management of the Ridgefield National Wildlife Refuge.

Sincerely,

Christopher Lapp
Refuge Manager