DISCLAIMER

Hanford Reach Fall Chinook Salmon Redd Monitoring Report for Calendar Year 2017

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

Contractor for the U.S. Department of Energy
under Contract DE-AC06-09RL14728

P.O. Box 650
Richland, Washington 99352

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J. J. Nugent
Mission Support Alliance

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1.0 INTRODUCTION

The U.S. Department of Energy, Richland Operations Office (DOE-RL) conducts ecological monitoring on the Hanford Site to collect and track data needed to ensure compliance with an array of environmental laws, regulations, and policies governing DOE-RL activities. Ecological monitoring data provide baseline information about the plants, animals, and habitats under DOE-RL stewardship at the Hanford Site required for decision making under the *National Environmental Policy Act* (NEPA) and *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA). DOE/EIS-0222, *Final Hanford Comprehensive Land Use Plan Environmental Impact Statement* (CLUP) evaluates the potential environmental impacts associated with implementing a comprehensive land-use plan for the Hanford Site for at least the next 50 years, and ensures that DOE-RL, its contractors, and other entities conduct activities on the Hanford Site in compliance with NEPA.

The vision for the DOE-RL managed portion of the Hanford Site focuses not only on the clean up of nuclear facilities and waste sites but on the protection of groundwater and the Columbia River, as well as the restoration of Hanford lands for access and use (DOE/RL-2009-10). To reach these goals DOE-RL is working closely with partners, such as the U.S. Fish and Wildlife Service and National Park Service, to enable use of the Hanford Site land consistent with the CLUP. As the Hanford Site moves toward accomplishing this vision, monitoring the ecological resources present to determine whether there is a need for conservation and/or protection of any resources will be critical for making informed decisions for responsible site stewardship.

DOE-RL places priority on monitoring plant and animal species or habitats that fit into one or more of the categories below:

- Regulatory protections or requirements
- Rare and/or declining species (i.e., federally or state listed endangered, threatened, or sensitive)
- Significant interest to federal, state, or Tribal governments or the public.

DOE/RL-96-32, *Hanford Site Biological Resources Management Plan*, (BRMP) ranks wildlife species and habitats (Levels 0–5) based on the level of concern for each resource. Fall Chinook salmon (*Oncorhynchus tshawytscha*) spawning areas are ranked as Level 5 resources, the highest ranking level in BRMP. According to the BRMP, “resources classified as Level 5 are the rarest and most sensitive habitats and species and are considered irreplaceable or at risk of extirpation or extinction.” The management goal of Level 5 resources is preservation and requires a high level of status monitoring.

Commonly referred to as king salmon, Chinook are the largest of the Pacific salmon (Myers et al. 1998, Netboy 1958). The Columbia River supports three major runs (spring, summer, and fall) of Chinook salmon, generally based on the season during which the adults re-enter the estuary to begin their upstream migration to spawn. Chinook salmon that spawn in the Hanford Reach of the Columbia River are fall-run fish. Fall Chinook salmon enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of the rivers, and spawn within a few days or weeks of freshwater entry (Myers et al. 1998, Fulton 1968, Healey 1991). Adult fall Chinook salmon destined for the Hanford Reach are upriver brights (fish retain their silver color during upstream migration) that enter the Columbia River in late summer and spawn in the fall. Spawning in the Hanford Reach typically begins in mid-October and lasts through November. The population of fall Chinook salmon that spawns in the Hanford Reach of the Columbia River is the largest run remaining in the Pacific Northwest and has regional, ecological, cultural, and economic importance that reaches areas downstream on the Columbia River and along the Pacific Ocean coast as far as southeast Alaska (Dauble and Watson 1997). These fall Chinook salmon have

been vital in efforts to preserve and restore other depleted Chinook salmon stocks in the Columbia Basin (Anglin et al. 2006).

Dauble and Watson (1997) found the initiation of spawning ranged from September 28 to October 26 with a median date of October 16. Females fan out nests or "redds" in suitable gravel substrate and deposit eggs in a pocket while males simultaneously extrude milt to fertilize the eggs. Redds are readily identifiable at this time and appear as clean swept gravel patches amidst darker undisturbed substrate covered by algae (periphyton). "Redd life" is a term describing the period during which periphyton growth has not rendered the redd substrate indiscernible from the surroundings. Redd life is typically about 6 weeks on the Hanford Reach (PNL-7289); however, redds have been recorded to remain visible for over 16 weeks (HNF-53665, HNF-56705).

Fall Chinook salmon redds have been monitored at the Hanford Site annually since 1948, including aerial counts, to provide an index of relative abundance among spawning areas and years (HNF-52190, HNF-54808, HNF-56707, HNF-58823, HNF-59813, HNF-63012). The counts are used to document the onset of spawning, locate spawning areas, and determine intervals of peak spawning activity. These data also allow for planning to avoid impacts such as disturbance or siltation to redds from Hanford Site activities. Understanding the location and abundance of spawning is a critical part of the management of this important population and facilitates protection of essential fish habitats safeguarded under the *Magnuson-Stevens Fishery Conservation and Management Act*.

The information collected during the aerial surveys is vitally important for the implementation of the Hanford Reach Fall Chinook Protection Program (HRFCPP; USACE 2006). The HRFCPP is an agreement among Public Utility District No. 2 of Grant County, Washington (Grant); Public Utility District No. 1 of Chelan County, Washington (Chelan); Public Utility District No. 1 of Douglas County, Washington (Douglas); DOE acting by and through the Bonneville Power Administration (BPA); National Oceanic and Atmospheric Administration Fisheries (NOAAF); Washington Department of Fish and Wildlife (WDFW); and the Confederated Tribes of the Colville Indian Reservation (CCT). The goal of this program is to protect Hanford Reach fall Chinook salmon during critical periods of their life cycle through operational constraints imposed on the Priest Rapids Hydroelectric Project.

2.0 METHODS

Aerial surveys of fall Chinook salmon redds were conducted in areas of the Hanford Reach consistent with past survey efforts and the historical data set (Figure 1). Eight additional sub-sections (100-B/C, 100-K, 100-N, 100-D, 100-H, 100-F, Dunes, and 300 Area) were added beginning in 2011 to monitor the abundance and distribution of fall Chinook salmon redds in areas of the Columbia River adjacent to contaminated groundwater plumes of the Hanford Site (Figure 2; DOE/RL-2018-32). These eight new sub-sections were divided so that redd counts and direct comparisons to historical records can still be made in the original areas.

The primary physical factors influencing the accuracy of aerial counts include depth of water over redds and water clarity. Wind action, available light, orientation of the river, and direction of the current can also affect redd counts. The accuracy of aerial counts also decreases with increasing numbers and density of redds within a large aggregate of redds (Visser et al. 2002). Flights are cancelled if weather conditions are not favorable (i.e., wind, fog, or low clouds). Field measurements suggest that the upper depth limit for detecting redds during aerial surveys conducted on the Hanford Reach was 3 to 4 m (10 to 13 ft) (PNL-7289), while other studies indicate that fall Chinook salmon spawn in water up to 9 m (30 ft) deep

(Swan 1989); therefore, a proportion of redds located in deeper water may not be detected during aerial surveys (PNL-7289). Because it is seldom possible to view all redds from the air, these counts provide only an annual index of relative abundance and distribution of fall Chinook salmon spawning in the Hanford Reach of the Columbia River.

Beginning in mid-October under the terms of the HRFCPP, river flows are reduced in the morning every Sunday (the day of the week with the lowest power demand) to the Priest Rapids Dam minimum operating discharge of 1,000 m^3/sec (36,000 ft^3/sec).

This allows the Agency (NOAAF, WDFW, and CCT) and Utility (Grant, Chelan, Douglas, and BPA) Party Monitoring Team to perform a ground survey of redd distribution at Vernita Bar just downstream of Priest Rapids Dam. These drawdowns occur every Sunday morning until the initiation of fall Chinook spawning has been set both above and below the 1,416 m^3/sec (50,000 ft^3/sec) flow elevations. A final drawdown is conducted on the Sunday prior to Thanksgiving to establish the minimum critical flow needed to protect pre-emergent fall Chinook. This weekly reduction in river flow can afford the excellent viewing conditions and, when possible, flights are scheduled concurrent with the Sunday morning drawdowns.

Flights are scheduled to encompass the entire fall Chinook spawning period, usually mid-October (initiation of spawning) through the end of November (end of spawning). Three to four flights are typically conducted during this period. Early flights (October) are conducted to establish the initiation of spawning, and later flights (November) occur during and just after the peak spawning period to establish the maximum redd count for the season by area and for the entire Hanford Reach. Multiple flights are necessary to minimize the effect of poor visibility or other sources of count variability that may occur during a single flight. Multiple flights also ensure comparability within the long-term database through consistency with past efforts. As a courtesy and consistent with past practices, aerial redd count information is shared with the HRFCPP parties to assist in the implementation of protective measures.

Survey flight altitudes range from 244 to 366 m (800 to 1,200 ft) with air speeds of 120 to 161 km/hr (75 to 100 mi/hr]). Widely spaced fall Chinook redds are individually counted, while tightly grouped clusters of redds are estimated in groups of 10 or 50. Heavy spawning areas require multiple aerial passes to collect complete counts. Observations begin in Richland at the Interstate 182 bridge and end at Priest Rapids Dam. Flights are conducted near noon to bracket the highest angle of the sun for optimum viewing conditions. Observers wear polarized glasses, as necessary, to reduce glare. All redds observed are documented by survey area on large format printed maps.

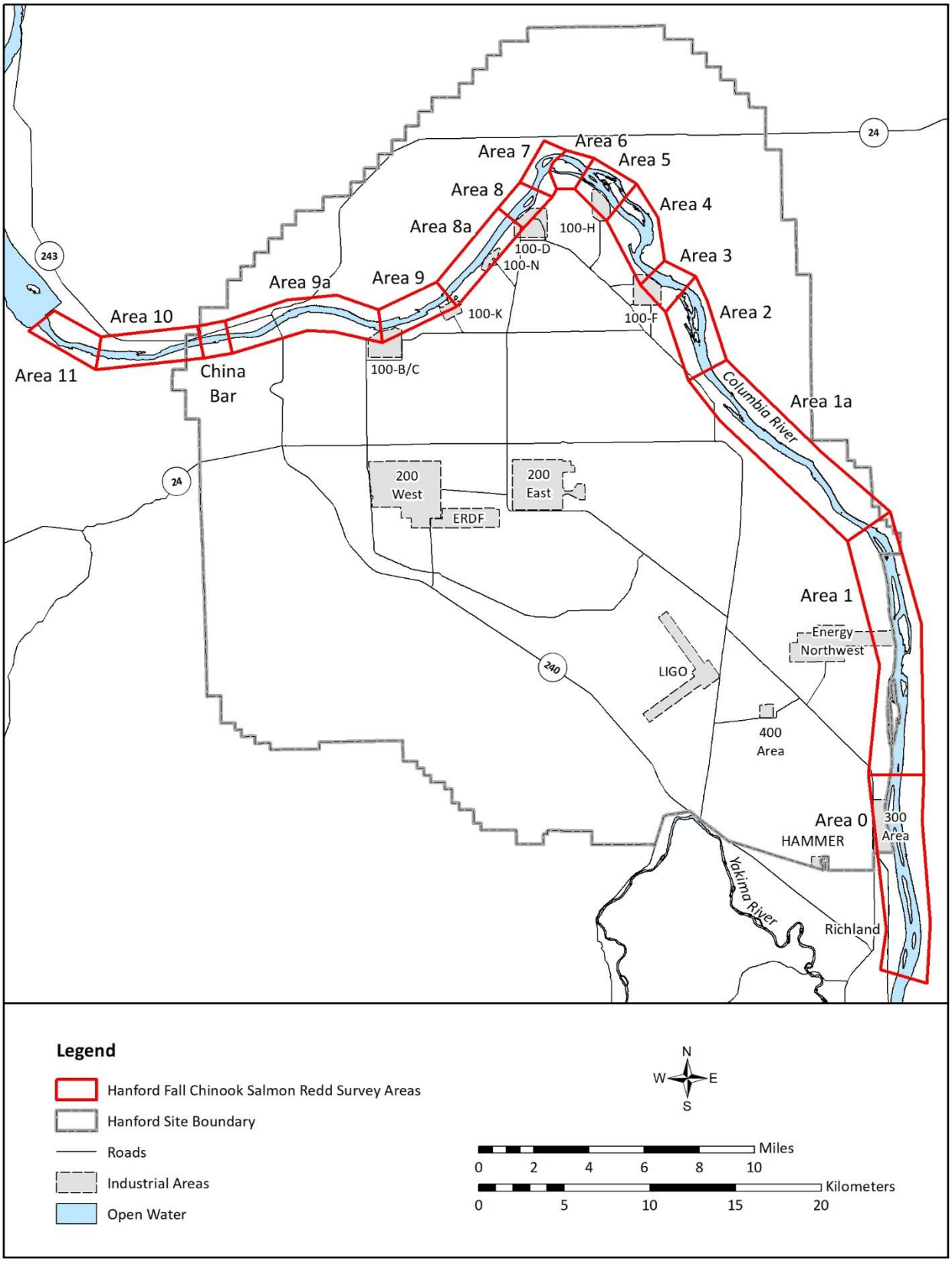

Figure 1. Aerial Survey Areas for Fall Chinook Salmon Redds Used Historically and in 2017

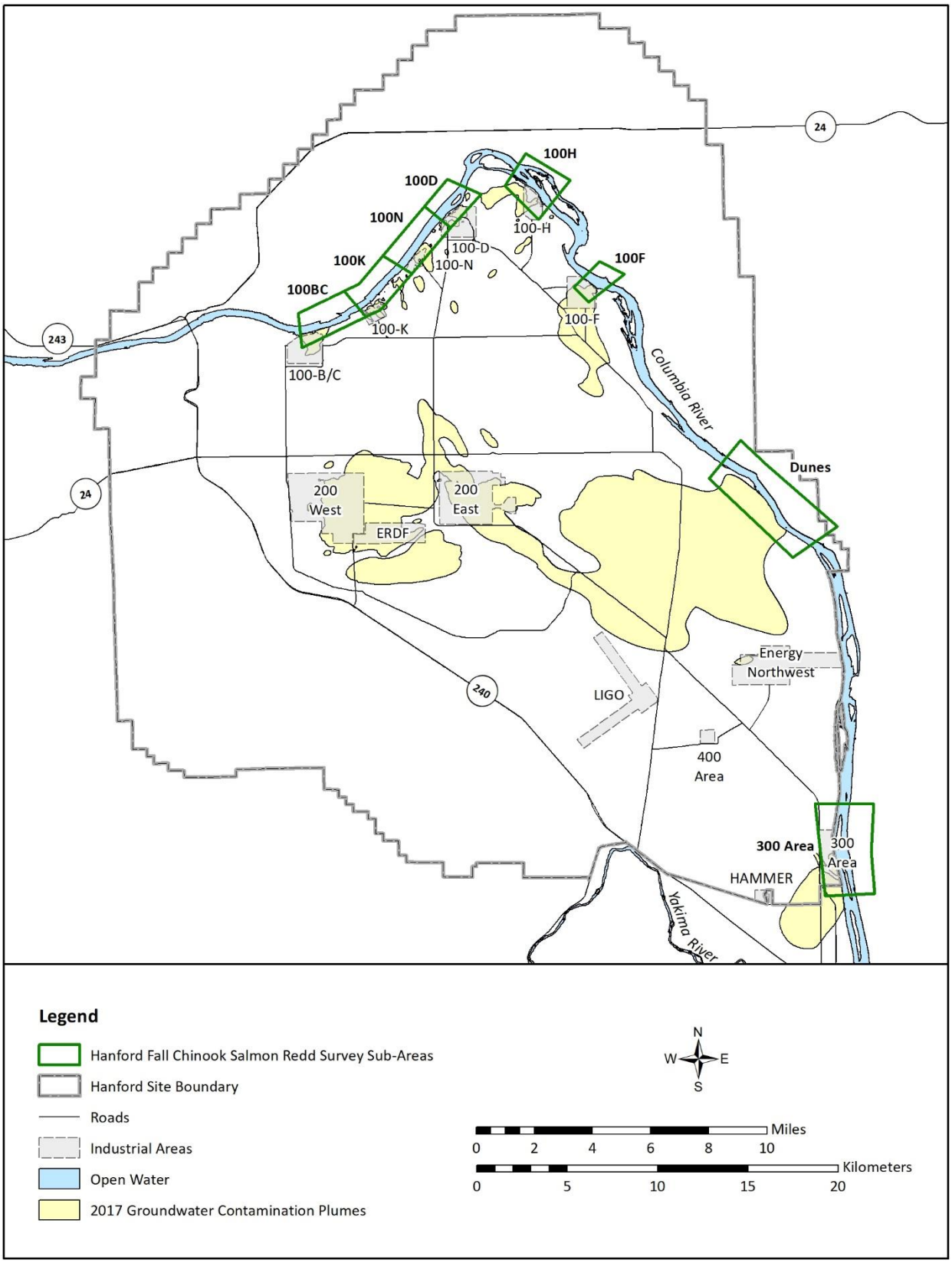

Figure 2. Fall Chinook Salmon Survey Sub-areas Adjacent to Groundwater Contamination Plumes

Because long-term trends in both redd abundance and distribution are important monitoring components, Mission Support Alliance has taken several steps to ensure compatibility and consistency with past efforts, which include the following:

- Thoroughly reviewing and adopting past monitoring protocols
- Coordinating/training with former redd count personnel
- Coordinating and exchange of information WDFW and with the Grant County Public Utility District to support the ongoing HRFCPP
- Using maps detailing the entire survey reach as well as all historical sub-areas and spawning sites both as in-flight guidance documents and as field data recording forms
- Using the same air service, airplane, and pilots in 2017 that were used in previous years.

3.0 RESULTS

Three aerial surveys were completed along the length of the Hanford Reach during 2017. The first survey was performed on October 23, the second on November 6, and the third on November 19. The counts performed by survey area for each flight are shown in Table 1. The maximum count describes the highest number of redds documented in a survey area within any single flight. The visual redd count total is calculated by summing the maximum redd count from each survey area, which equaled 8,648 in 2017. The number of redds counted within the newer defined sub-areas coinciding with Hanford Site operational areas is shown in Table 2. Viewing conditions were excellent on the first flight, good on the second flight, and fair on the third flight with several small bands of fog from Vernita Bar to Priest Rapids Dam.

Table 1. Summary of Fall Chinook Salmon Visual Aerial Redd Counts for the Calendar Year 2017 Aerial Surveys in the Hanford Reach, Columbia River.

Area	Description	10/23/2017	11/06/2017	11/19/2017	Maximum Count
0	Islands 17–21 (Richland)	0	2	0	2
1	Islands 11–16	11	120	280	280
1a	Savage Island/Hanford Slough	0	0	0	0
2	Islands 8–10	19	864	900	900
3	Near Island 7	0	22	670	670
4	Island 6 (lower half)	5	680	900	900
5	Island 4, 5, and upper 6	11	418	911	911
6	Near Island 3	0	40	500	500
7	Near Island 2	0	281	790	790
8	Near Island 1	2	145	330	330
8a	Upstream of Island 1 to Coyote Rapids	0	0	0	0
9	Near Coyote Rapids	0	0	80	80
9a	Upstream of Coyote Rapids to China Bar	0	0	0	0

China Bar	China Bar/Midway	4	14	75	75
10	Near Vernita Bar	85	1,310	3,200	3,200
11	Upstream of Vernita Bar to Priest Rapids Dam	0	0	10	10
	Total	**137**	**3,896**	**8,646**	**8,648**

Table 2. Summary of Fall Chinook Salmon Visual Aerial Redd Counts for the Calendar Year2017 Aerial Surveys by Operational Area Sub-Sections.

Sub-area	10/23/2017	11/06/2017	11/19/2017	Maximum Count
300 Area	0	2	0	2
Dunes	0	0	0	0
100-F	0	22	670	670
100-H	11	418	911	911
100-D	2	145	330	330
100-N	0	0	0	0
100-K	0	0	0	0
100-BC	0	0	80	80
Total	**13**	**587**	**1,991**	**1,993**

4.0 DISCUSSION

The peak annual redd count for 2017 (8,648) was the ninth highest count since 1948 and was less than the previous 10-year average (10,800). The historical trend in redd counts since 1948 is shown in Figure 3. Fall Chinook salmon redd counts on the Hanford Reach in 2017 decreased by 34.8% from the 2016 redd count (13,268). Although the redd count decreased in 2017, the recent annual redd counts was more similar to the previous 20-year average (8,943).

Wintering Bald Eagles (*Haliaeetus leucocephalus*) feed on post-spawned fall Chinook salmon carcasses that wash up along the shores of the Hanford Reach; their numbers vary dependently on spawning fall Chinook salmon numbers (Fitzner and Hanson 1979). A comparison of the peak annual fall Chinook salmon redds count and the peak annual wintering Bald Eagles count in the Hanford Reach from 1961 to 2017 is shown in Figure 4.

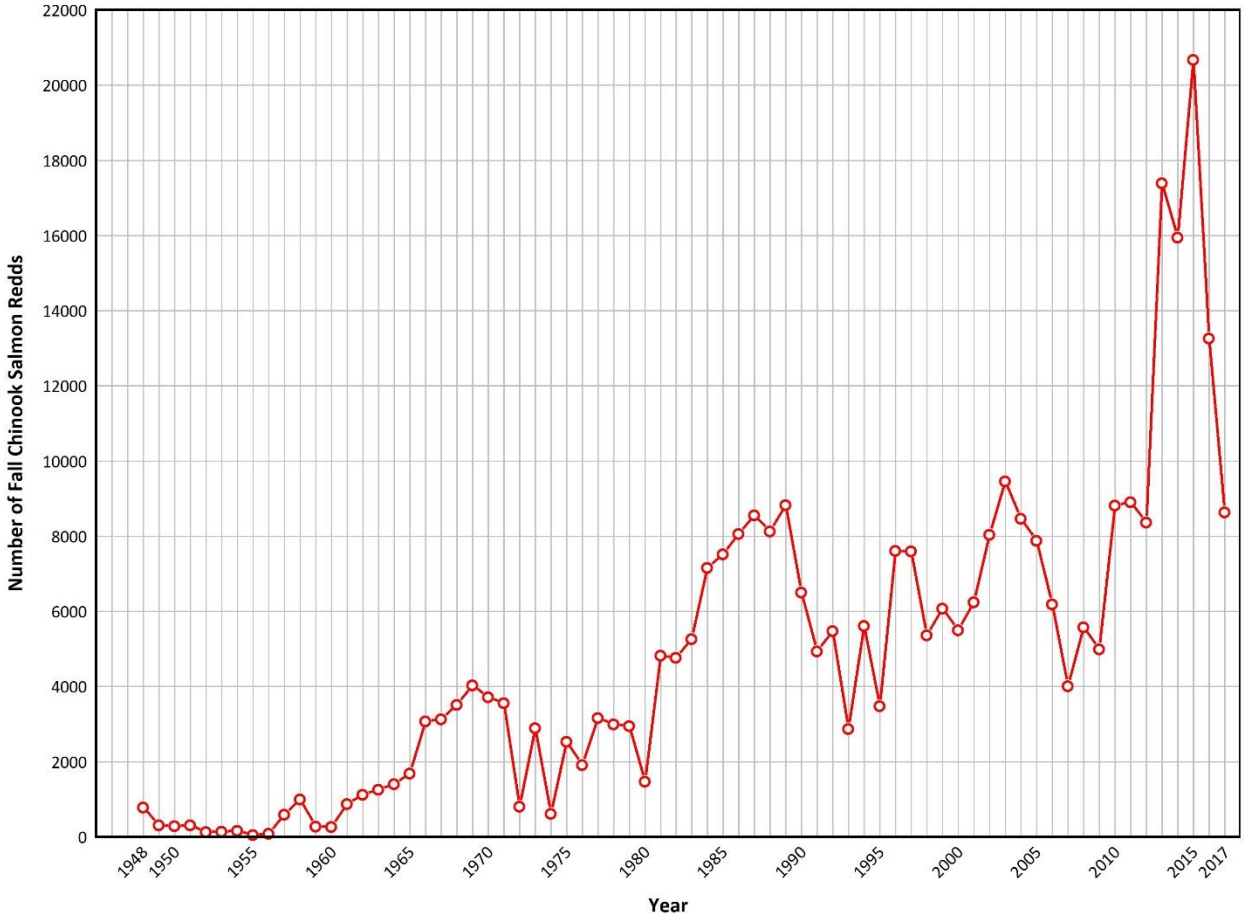

Figure 3. Visual Hanford Reach Fall Chinook Salmon Redd Counts 1948 to 2017

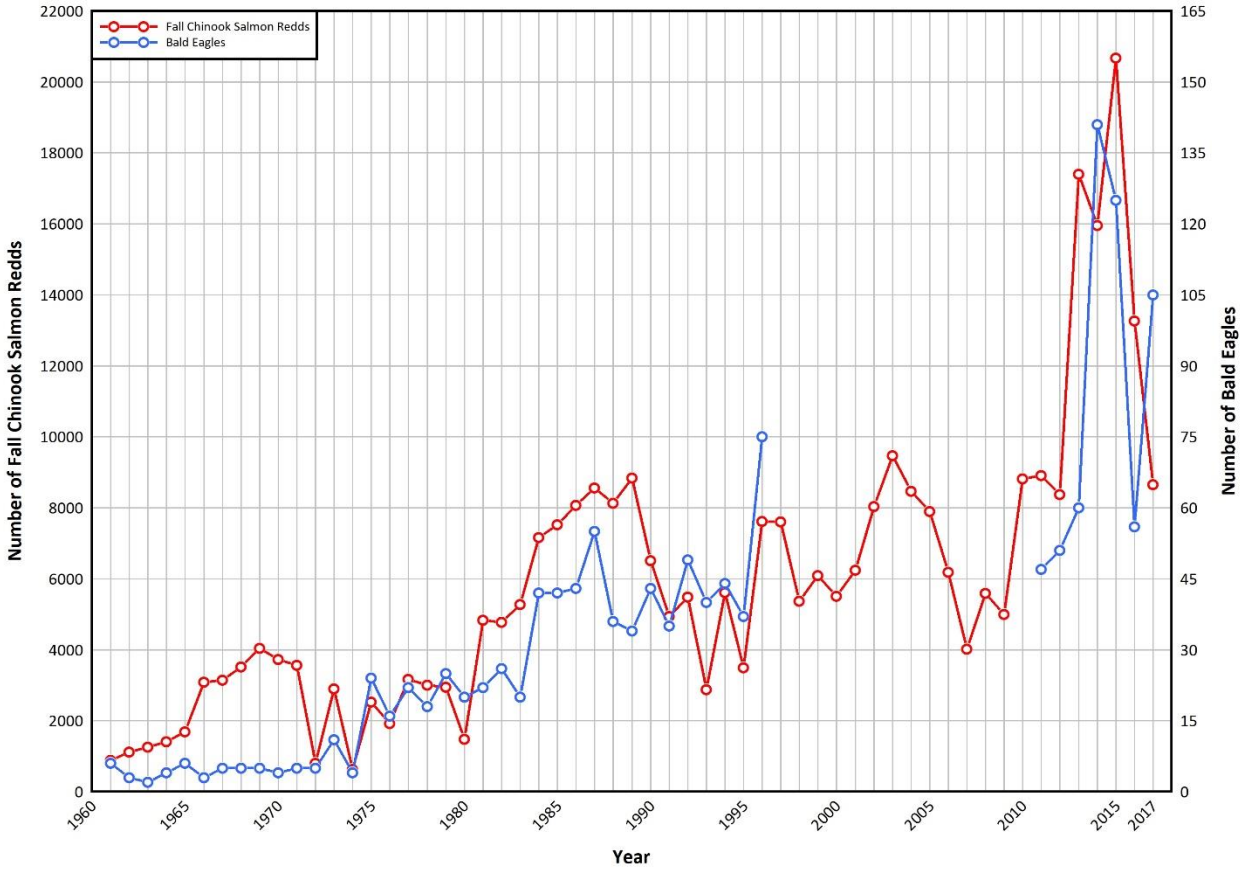

Figure 4. Peak Annual Count of Fall Chinook Salmon Redds and Wintering Bald Eagles in the Hanford Reach from 1961 and 2017

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