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UNITED STATES DISTRICT COURT

DISTRICT OF OREGON

EUGENE DIVISION

MARION COUNTY, a Political Subdivision of the State of Oregon, Case No. 6:26-cv-956-MTK (Lead Case)
6:26-cv-1381-MTK (Trailing Case)

Plaintiff,

DECLARATION OF KIRK SCHROEDER

and

SANTIAM WATER CONTROL DISTRICT,
and CITY OF STAYTON, an Oregon
municipal corporation,

Intervenor-Plaintiffs,

v.

U.S. ARMY CORPS OF ENGINEERS,
DANIEL P. DRISCOLL, in his official capacity
as Secretary of the Army, and WILLIAM H.
GRAHAM, JR., in his official capacity as Chief
of Engineers and Commanding General of the
U.S. Army Corps of Engineers,

Defendants,

and

NORTHWEST ENVIRONMENTAL

DEFENSE CENTER and NATIVE FISH
SOCIETY,

Defendant-Intervenors.

CITY OF SALEM, an Oregon Municipal
Corporation,

Plaintiff,

and

SANTIAM WATER CONTROL DISTRICT,
and CITY OF STAYTON, an Oregon
municipal corporation,

Plaintiff-Intervenors,

v.

UNITED STATES OF AMERICA, and
UNITED STATES ARMY CORPS OF
ENGINEERS, an agency of the United States
government,

Defendants,

and

NORTHWEST ENVIRONMENTAL
DEFENSE CENTER and NATIVE FISH
SOCIETY,

Defendant-Intervenors.

I, Kirk Schroeder, declare as follows:

1. I have personal knowledge of the facts set forth below and if called as a witness I would and could truthfully testify to these facts.

2. I have been asked to provide my expert opinion on the drawdown at Detroit Reservoir as an interim passage measure required by the 2024 Biological Opinion (“BiOp”, RPA 4.12.2, p. 6.4-524). The long-term proposal is for a structural fish passage measure (floating screen structure (2024 BiOp RPA 4.13.5, pp. 6.4-529–530)), although implementation requires a lengthy design and construction process and is dependent on obtaining the necessary funds (Record of Decision for SEIS, p. 12)¹.

3. I provided previous expert declarations in *Northwest Env'tl. Defense Ctr. v. U.S. Army Corps of Engrs.*, No. 3:18-cv-437-HZ, ECF Nos. 37, 76, 97, 119, 144 (D. Or., filed Mar. 13, 2018). I served on the court-appointed expert panel to develop measures and implementation plans to address dam operations and fish passage. *Id.* at ECF Nos. 196, 208, 224, 228, 233, 238, 240, 249, 278, 293, 297

4. I have appended details about my professional qualifications and experience. In brief, I have spent over 40 years researching, analyzing data, and monitoring salmon and steelhead, 36 of which I was employed with the Oregon Department of Fish and Wildlife (“ODFW”). I have extensive experience with Willamette River salmonids through the Willamette Spring Chinook Research Project (1966–2013), and served as the Project Leader in 2004–2013. I have continued to work with the Willamette River research project and write

¹ Record of Decision, Willamette Valley System Operations and Maintenance Final Supplemental Environmental Impact Statement, dated 23 June 2026 (link to document at <https://www.nwp.usace.army.mil/WVS-EIS/>)

research papers. Two recent papers that I discuss in this declaration are attached at Exhibits A and B (Schroeder et al. 2016; Schroeder et al. 2026).

Background on Listing and Status

5. Upper Willamette River (UWR) spring Chinook salmon and winter steelhead were listed as threatened species under the Endangered Species Act in 1999 and the listing was last reaffirmed in 2024. UWR Chinook and steelhead are the only two native runs of anadromous² salmonids upstream of Willamette Falls.

6. Peak passage of adult spring Chinook salmon at Willamette Falls generally is late April through May with part of the run extending into late August and early September. Adult salmon historically migrated to the upper portion of watersheds to hold in pools and sections of river that have low water temperatures through summer. Adult salmon in the North Santiam River must now hold and spawn in the lower reaches of the river because access to the upper watershed is blocked by Big Cliff and Detroit Dams. Adult salmon (primarily hatchery origin) have been transported and released (outplanted) into the Breitenbush and North Santiam rivers upstream of Detroit reservoir in an effort to reintroduce salmon into their historic habitat. Spawning generally begins in late August and continues into early October, with peak spawning in September. Success of the outplanting program has been poor as measured by the return of adults produced by the outplanted fish or cohort replacement rate (CRR). CRR must be >1.0 for a population to increase. For the adult Chinook outplanted upstream of the reservoir in 2011–2019, the average CRR was 0.46 (0.1–1.0), well below levels necessary for the population to increase in 8 of 9 years (O'Malley et al. 2023; 2026). Lack of safe and effective downstream

² Anadromous fish are those that spawn in freshwater, migrate to the ocean, and return to freshwater.

passage for juvenile salmon produced by the outplanted adults is likely a primary reason for low CRR.

7. Peak migration of UWR native steelhead is in late March–April, with some fish moving from mid-February to mid-May. They spawn in March through June in mainstem rivers and smaller tributaries, with peak spawning in late April and early May. As with UWR Chinook, access to historic spawning and rearing areas in the upper watershed is blocked by dams. Winter steelhead have not been outplanted upstream of Detroit reservoir because the population is entirely wild and in low abundance, and downstream passage at the dams is not currently effective enough to implement outplanting as a recovery measure.

8. The most recent 5-year review on the status of spring Chinook salmon in the North Santiam found that the population is at a high risk of extinction (NMFS 2024). To achieve recovery and delisting, the North Santiam population (one of four core populations in the UWR ESU³), must reach the status of a low risk of extinction. In order to reach this status, NMFS has estimated that the return of adult natural origin (“wild”) fish must increase by 5,400 fish (2024 BiOp p. 4.6-256), and is currently at < 10% of that target number (NMFS 2022, p. 179). Restoring access to historic spawning and rearing habitat in the upper watershed has been identified as a key measure to reducing risk to the North Santiam Chinook population, which will require safe and effective downstream passage for juvenile salmon through dams (NMFS 2024). Habitat downstream of Detroit and Big Cliff dams is impaired because water is too warm to

³ Evolutionarily Significant Unit (ESU) is a Pacific salmon population or group of populations that is substantially reproductively isolated from other populations and that represent an important component of the evolutionary legacy of the species. The UWR Chinook and steelhead ESUs are the entities listed as threatened under the Endangered Species Act.

support successful spawning, resulting in high mortality of adults before spawning (“prespawn mortality”) and accelerated incubation of eggs.

9. The 2024 status review determined the winter steelhead population in the North Santiam was at a low to moderate risk of extinction, but there is much uncertainty about the status because data are lacking. A goal of increasing the number of spawners by about 4,700 fish was proposed to reach a very low risk of extinction (2024 BiOp p. 4.6-257), which is considered necessary to achieve recovery. Spawning survey data have been inconsistently collected and counts at Bennett Dam only cover 2013–2024. The 5-year mean count of winter steelhead at Bennett Dam was 514 (2015–2019), well below recovery goals. Although counts in 2019 and 2020 suggest a rebound in numbers from record lows in 2017, the current “high” numbers are equivalent to previous lows (NMFS 2024, p. 18). In general, available data indicate a long-term decline in abundance for the North Santiam winter steelhead population (NMFS 2022, p. 185). Overall, the native UWR steelhead ESU is considered to be at a moderate to high risk of extinction with a declining trend in viability (NMFS 2024, p. 19). As with Chinook salmon, lack of access to historic spawning and rearing habitat and lack of safe, effective passage at dams for juvenile fish is considered a key risk to the North Santiam population (NMFS 2024, p. 27).

10. The continued decline of the UWR Chinook salmon and steelhead populations in the North Santiam River is concerning not only for these individual populations, but also for the overall UWR salmon and steelhead populations. Declining trends in both abundance and productivity jeopardizes the prospects for recovery and delisting the North Santiam populations, and the UWR Chinook and steelhead ESUs. Federal reviews note that restoration of access to upper watersheds is a key element in reducing risks to the populations (NMFS 2022, p. 180), and

that “lack of safe downstream passage for juveniles at high-head dams continues to be a primary factor limiting recovery for both species” (NMFS 2024, p 30).

Life History Diversity and Importance to Populations

11. Spring Chinook salmon and winter steelhead from the same brood year spend variable time in freshwater habitats before migrating to the ocean and variable time in the ocean before returning to freshwater to spawn. Thus, the different migratory and rearing behaviors exhibited by fish that were born in the same year is known as life history diversity. Research of UWR juvenile Chinook documented six primary and four secondary life histories of juvenile fish based on rearing and migratory behaviors prior to migrating to the ocean from the Willamette River as smolts (Schroeder et al. 2016). UWR Chinook migrated to the ocean as smolts in either their first year of life (subyearling) or their second year (yearling).

12. Juvenile salmon rear in habitats throughout the entire UWR basin, including areas near spawning grounds and areas hundreds of miles downstream. In addition to taking advantage of a variety of rearing habitats, the downstream movement of part of the population limits the exposure of the entire population to natural events that may have localized effects such as landslide and floods, and human-caused events such as municipal sewage discharge during high rainfall. In other words, risks to individuals are spread out because the population occupies different habitats at different times (i.e., not all eggs are in one basket). Consequently, the population as a whole is buffered from environmental effects that may be detrimental to a particular group of fish within the population, which allows populations to respond to changing environmental conditions both in the short-term and in the long-term (adaptation).

13. Although less is known about the juvenile life history of winter steelhead, they also have a diverse freshwater life history. Juvenile steelhead rear in both mainstem habitats and

tributaries for 1–4 years, most frequently for 2 years, before migrating to the ocean as smolts in April and May.

14. In addition to a varied juvenile life history that provides stability to the total number of smolts, salmon and steelhead spend varying times in the ocean before returning to freshwater as adults to spawn. In a study that spanned 18–22 years, 10–17 life histories were identified in returning adult UWR Chinook salmon based on combinations of freshwater and ocean ages from analysis of scales (Schroeder et al. 2026). A diverse combination of freshwater and ocean ages is also present in UWR steelhead that spend 1–4 years in the ocean before returning to freshwater, with two ocean years being most common. Unlike Chinook salmon that die after spawning, steelhead can go back to the ocean and return to spawn more than once, which adds to their life history diversity.

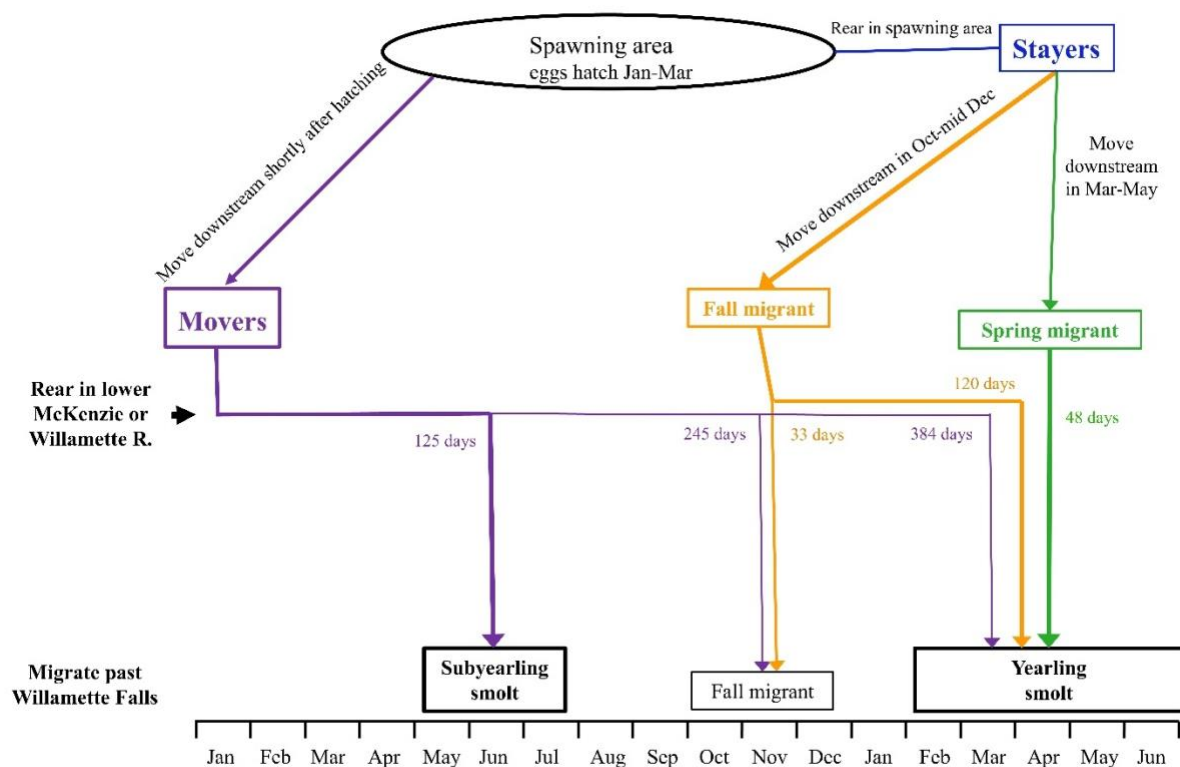
15. This diversity in life history in UWR Chinook salmon and steelhead provides stability to the population in the number of adults that return to spawn and is known as a “portfolio effect”; that is, a diversified financial portfolio is more stable and less risky than one with few investment types. For example, the variable contribution of diverse life histories in the North Santiam Chinook salmon population resulted in adult returns that were 2.4 times more stable on average (2002–2019) than if the population contained fewer life histories that were synchronous with each other (Schroeder et al. 2026). Within the freshwater phase of life, the variable contribution of life histories to smolt production in UWR Chinook salmon resulted in smolt numbers that were over 1.5 times more stable than if there were fewer life histories with similar behaviors (synchronous with each other) (Schroeder et al. 2016). Life history diversity in steelhead has also been shown to provide resilience and stability to populations (e.g., Moore et al. 2014).

16. Although the existing diversity of Chinook salmon contributed to stability in adult returns, adult salmon in the North Santiam population were significantly younger at age of return and had a smaller proportion of yearlings in 2002–2019 compared to Willamette Chinook salmon sampled in 1946–1951 (prior to dam construction). In contrast, the life history composition of the McKenzie and Clackamas populations were largely unchanged from 1946–1951 to 2002–2019 (Schroeder et al. 2026). These data indicate that construction of dams and loss of access to the upper watershed had a significant impact on life history composition of the North Santiam population. A yearling smolt life history (juveniles remaining in freshwater until their second year of life) is favored in the cold water habitats that are found in upper watershed areas, and increasing the contribution of the yearling life history could increase adult returns (*see* ¶¶ 22–24).

17. To summarize, salmon and steelhead migrate and rear in different habitats at different times throughout their life. They spread out throughout a watershed, which not only allows the population to use a variety of habitats, lowers the number of fish rearing in the same area (reduces competition), and increases opportunities for growth, but also decreases the exposure of the population to risks. Similarly, different age classes of salmon and steelhead reside in the ocean at different places and at different times thereby reducing risk and increasing opportunities for growth. In combination, diversity in freshwater and ocean residence can buffer populations against both local and widespread unfavorable conditions. For example, if ocean survival was poor in one year, fish with variable freshwater ages would enter the ocean in different years and provide a buffering effect against bad conditions compared to a population with a single life history all entering the ocean at the same time.

Juvenile UWR Chinook Life Histories

18. Juvenile salmonids that migrate downstream during the fall are an important life history in UWR populations because of their contribution to the stability and resilience of the species. The Chinook salmon population within the McKenzie River, where access to upper watershed areas exists, demonstrates the benefits of a fall migration life history. Some juvenile salmon in the McKenzie population move shortly after hatching to rear in downstream areas, whereas other fish rear in the spawning areas in cold water habitat that favors a yearling life history (Figure 1). Of the juvenile salmon that reared near spawning areas, a large migration to downstream habitats occurred in fall and early winter. Although some fall migrants moved quickly to the Columbia River, almost 70% reared over the winter in lower reaches of the tributaries or in the Willamette River upstream of Willamette Falls and migrated as yearling smolts (Schroeder et al. 2016). In other words, juvenile salmon migrating to downstream areas in fall and early winter make an important contribution to the total number of yearling smolts, which was a successful life history in the McKenzie population.



adapted from Schroeder et al. 2016, *Can. J. Fish. Aquat. Sci.* 73: 921–934

Figure 1. Migratory and rearing pathways of juvenile Chinook salmon in the McKenzie River. Pathways include fish that migrate from spawning areas as fry to rear downstream (movers = purple line) and those that rear in spawning areas (stayers = blue line). Of the stayers, most migrated to downstream areas in fall-winter (fall migrants = orange lines) and the rest migrated in the spring of their second year of life (spring migrant = green line). Thicker lines and boxes represent the dominant pathways and smolt life histories (e.g., most of the fall migrants reared over the winter and migrated past Willamette Falls as yearling smolts). The number of days that juvenile salmon reared downstream of spawning areas is given next to pathway lines.

19. Access to the upper watershed of the North Santiam basin is presently blocked by Big Cliff and Detroit dams. Upper watershed areas contain high-quality habitat with water temperatures that are lower than downstream of the dams and can support more life history types

than the lower watershed alone. Access to upper watershed areas coupled with safe and effective downstream passage for juvenile salmonids at the dams are key measures for recovery of the North Santiam populations (§§ 8–9). Increasing the number of fall migrants (and in turn yearling smolts), which generally rear in upper watershed areas where habitat conditions are more favorable, is important to strengthening the survival and recovery of the species, as explained in more detail below.

20. Access to upper watershed areas will become increasingly important as air and water temperatures continue to increase because of climate change. For example, one study found that suitable adult migration and holding habitat for Chinook salmon in the North Santiam is likely to decline by 25–50% downstream of the dams by 2050, whereas habitats upstream of the dams are predicted to remain suitable for Chinook salmon and winter steelhead (Fullerton et al. 2026). In addition, the amount of area downstream of the dams with suitable incubation temperatures is predicted to decline for both species while the amount of area above the dams with suitable temperatures is expected to remain stable or increase.

Importance of Fall Drawdown

21. Reservoir drawdown as an interim operational measure for passing salmon and steelhead migrants downstream of dams has long been identified as an important component of population viability and recovery by increasing spatial distribution, diversity, productivity, and abundance of the listed species (e.g., *see* 2008 BiOp, Chapter 9, 4.8, pp. 9-43–44). In deciding that injunction measures were necessary, U.S. District Judge Hernández noted, “[t]he evidence demonstrates that volitional fish passage is biologically necessary, and spill operations and deep drawdown measures represent the most effective means for providing safe fish passage under current dam configurations.” (*Northwest Env'tl. Defense Ctr. v. U.S. Army Corps of Engrs.*, No.

3:18-cv-437-HZ, ECF 212, p. 9). The 2024 BiOp requires fall drawdown operations at Detroit Dam to test and improve effectiveness of interim juvenile fish passage (2024 BiOp, RPA 4.12.2, p. 6.4-524), and this measure was included in the 2025 Willamette Valley System operations and maintenance EIS (Chapter 2, 2.8.3.1, pp. 27–29) and the 2026 Supplemental EIS (SEIS Chapter 2, p. 19).

22. Benefits derived by providing access for adult salmon and steelhead to spawn in upper watershed areas will be realized only if safe and effective downstream passage for diverse life histories of juvenile fish is available at the dams. Providing passage at Detroit Dam for fall migrating juvenile Chinook salmon will allow expression of the inherent life history diversity in Chinook salmon that is critical for the resilience and stability of a population and its recovery. Passage of fall migrants will increase overall smolt production in the North Santiam population and ultimately adult returns.

23. For example, based on extensive research of juvenile Chinook migration, 72% of fish that reared through their first summer in the upper part of the McKenzie watershed migrated to downstream areas in October–January with peak migration in November through mid-December (Schroeder et al. 2016). Some fall migrants continued past Willamette Falls to the Columbia River estuary, but most overwintered in lower reaches of the McKenzie River and in the Willamette River before migrating to the ocean as yearling smolts in the spring (Figure 1). Thus, the fall migrants make a significant contribution to the total number of yearling smolts, and yearling smolts are a successful life history. The North Santiam salmon population has a lower percentage of adults with a yearling life history and a lower return of adults than the McKenzie, Clackamas, and Sandy populations: 53% vs 73–86%, and 655 adults vs 1,907–2,292 adults.

24. As noted previously, the percentage of adult salmon with a yearling life history in the North Santiam population is lower in the contemporary period than was found in the Willamette population prior to dam construction (§16). Factors affecting the expression and abundance of a yearling life history include: A) fish that rear in upper watersheds with cold temperatures grow slower and reach smolt size in their second year of life, compared to fish rearing in the lower watershed that often migrate as subyearling smolts, B) conditions in downstream habitat such as high summer temperatures is unfavorable for a yearling life history strategy because yearlings rear in freshwater habitats through the summer and fall of their first year of life, and C) ability to freely migrate and rear throughout the entire watershed increases spatial distribution, life history diversity, and productivity, thereby increasing adult abundance. Because fall migrants significantly contribute to the overall yearling smolt production (Figure 1), increasing the safety and effectiveness of downstream passage at the dams through a fall drawdown is a measure that would likely increase the number of returning adults. A model developed to assess four management scenarios for increasing returns from outplanted adult salmon found that increasing dam passage survival of juveniles resulted in the highest increase in returning adult spawners (Keefer et al. 2026). In comparison, fewer adult spawners were produced under the scenarios of reducing adult prespawn mortality, increasing reservoir survival for juvenile salmon, or increasing egg-to-fry survival downstream of the dams.

25. Reservoir drawdown to pass juvenile salmon in the fall has been effective at other UWR projects. A study of the Green Peter reservoir drawdown and passage through the

regulating outlets (RO) found that both dam passage efficiency⁴ (0.89) and dam passage survival (0.73) were high (Larson et al. 2024).

26. A different statistical analysis was conducted to assess project passage efficiency⁵ and the effectiveness of injunction measures (such as fall drawdown) at Cougar Dam by comparing trap catch rates of juvenile salmon at the head of the reservoir to those downstream of the dam (McCallister et al. 2024). Results indicated that the proportion of available fish (those entering the reservoir) that passed the dam during the fall drawdown increased by more than 21 times in the post-injunction period compared to the pre-injunction period. In other words, the injunction measure of drawing down Cougar reservoir November 15–December 15 with passage through the RO greatly increased the number of juvenile salmon passing the dam. Large numbers of juvenile salmon passed through the RO at Cougar Dam in the fall drawdown based on expanded trap catches: 84,775 in 2021 (Flaherty et al. 2023); 211,768 in 2021–2023 (McCallister et al. 2024).

27. Studies of the deep drawdown at Fall Creek Dam found that more than 95% of tagged juvenile salmon passed downstream within 48 hours when the reservoir had dropped from 720 ft to 700 ft., or about 20 ft above the RO (2024 BiOp, p. 4.2-192). In addition, catch of juvenile salmon in a trap downstream of the dam peaked during the drawdown, and few were caught after the drawdown, indicating most had passed downstream during the drawdown (Murphy et al. 2019). These data indicate fall drawdown is an operational measure that provides safe and effective passage for juvenile salmonids, and can pass large numbers of fish.

⁴ Dam passage efficiency is the proportion of total fish passing the dam through any route relative to the number of total fish detected in the near forebay of the dam and are therefore available to pass.

⁵ Project passage efficiency is the ratio of fish abundance at the tailrace of the dam compared to that at the head of the reservoir within a single season (e.g., subyearling fish migrating in fall).

28. Providing fall passage at Detroit using reservoir drawdown is a required interim measure in the 2024 BiOp (RPA 4.12.2, p. 6.4-524) until a long-term structural measure can be implemented (RPA 4.13.5, pp. 6.4-529–530, 6.4-544). Because of the extensive time needed to design, fund, and implement the long-term measure (until at least 2035), fall drawdown remains the only viable and effective option of providing passage for fall migrants for nearly a decade, or much longer. Uncertainty about funding for structural passage increases the importance of using drawdowns to provide passage because that may end up being the long-term option. As noted in the Record of Decision for the SEIS: “The design and construction process is a lengthy process, and the structures carry significant costs which can lead to challenges with funding. Interim Operations provide a way to improve passage and water quality given these challenges” (ROD for SEIS, p. 12).

29. The rationale for the deep drawdown is to increase access to RO outlets by lowering the reservoir elevation to provide a passage option with higher passage survival and to increase life history diversity in the North Santiam population (2024 BiOp, p. 6.4-524). Juvenile salmonids are surface-oriented (*see* review of Smith et al. 2009), therefore passage efficiency will increase when the depth of water over the entrance to a passage route is reduced. The minimum conservation pool for Detroit reservoir is 1,450 ft elevation, which is 110 ft above the upper RO, a depth that is too great for juvenile salmon to effectively sound (2024 BiOp, p. 5.6-424). The Corps has proposed an incremental approach for the fall deep drawdown that would begin with a drawdown to 1,425 ft elevation, which lowers the forebay depth over the RO to 85 ft., with a target level of 1,395 ft, which would lower the depth over the RO to 55 ft (SEIS, Chapter 3, p. 137). Juvenile salmon are much more likely to find the RO outlet if the forebay surface is 55 ft above the outlet as opposed to 110 ft.

30. A fall study of juvenile salmon passage at Detroit Dam tested passage through both the powerhouse (1,403 ft) and the upper RO (1,340 ft) when the reservoir was lowering to minimum conservation pool of 1,540 ft and found that most passage occurred through the powerhouse route (Beeman et al. 2014), as expected when the powerhouse is operating because the powerhouse entrance is 63 ft above the RO and at least 130 ft away horizontally. The passage rate was 16% greater at a forebay elevation of 1,450 ft than at 1,500 ft. Passage preference could not be analyzed in the second year of the study because too few tagged fish used the RO. However, there was a 12% increase in passage rate per 10-ft reduction in forebay elevation for fish that passed through the powerhouse (Beeman and Adams 2015), indicating the effectiveness on juvenile salmon passage of decreasing the depth of the reservoir forebay. Studies of survival through the powerhouse and RO found that passage through the powerhouse was 54% compared to 72% and 94% through the RO at a 1 ft and 5 ft gate opening,⁶ respectively (reviewed in Hansen et al. 2017), indicating the RO provides the safest passage route in the fall if the fish can find that outlet.

31. To summarize, a deep drawdown in the fall is needed to reduce the depth of the reservoir so that juvenile salmon can sound and locate the RO for downstream passage. A deep drawdown in the fall is the only available downstream passage measure that is safe, effective, and will improve the survival of fall migrants. In turn, increasing the survival of fall migrants can increase the contribution of the yearling life history to adult returns, and contribute to the recovery of the UWR Chinook ESU.

⁶ Discharge through regulating outlets is controlled by hydraulically powered gates located about 40 ft. within the RO conduit. Discharge through the RO is dependent on forebay depth and the size of the gate opening. The RO is about 6 ft wide by 10 ft high in front of the gate and 7 ft wide by 16 ft high behind the gate. The RO conduit exits on the face of the spillway and discharges into the tailrace (Duncan and Carlson 2011).

Turbidity Issues⁷

32. Detroit Dam was previously lowered to 1,425 ft in 2015 to augment low flow in the North Santiam River, and in 2019 for an extended period to conduct spillway gate maintenance (SEIS Chapter 2, p 19). Turbidity measurements at the USGS Niagara monitoring station remained relatively low during these drawdowns: daily maximum of 15 FNU⁸ and daily median < 10 FNU in 2015; daily maximum and median < 10 FNU in 2019 (data from USGS Niagara station 14181500 located 3.6 miles below Detroit Dam and 0.8 miles below Big Cliff Dam). During the 2015 drawdown the daily maximum turbidity lasted 6 and 10 days in two pulses with maximum levels of 13 FNU and 15 FNU. However, during the first pulse there was little change in the daily median level indicating the small spikes were brief. During the second pulse, the slightly elevated turbidity level (7–10 FNU) lasted 10 days based on daily maximums and 7 days based on daily median (Figure 2).

⁷ Turbidity data in this section is found at the following websites: Niagara: <https://waterdata.usgs.gov/monitoring-location/USGS-14181500/>; North Santiam below Stout Creek: <https://waterdata.usgs.gov/monitoring-location/USGS-14183020/>; South Santiam at Waterloo: <https://waterdata.usgs.gov/monitoring-location/USGS-14187500/>.

⁸ Turbidity is used as a surrogate for suspended sediment loads and is measured by sensors as the scatter of a light beam in water at 90° angle expressed as Formazin Nephelometric Unit (FNU). For North Santiam measurements, these units are equivalent to Nephelometric Turbidity Unit (NTU) used prior to 2004 and USGS has converted records to FNU (*see* Uhrich and Bragg 2003; Bragg et al. 2007).

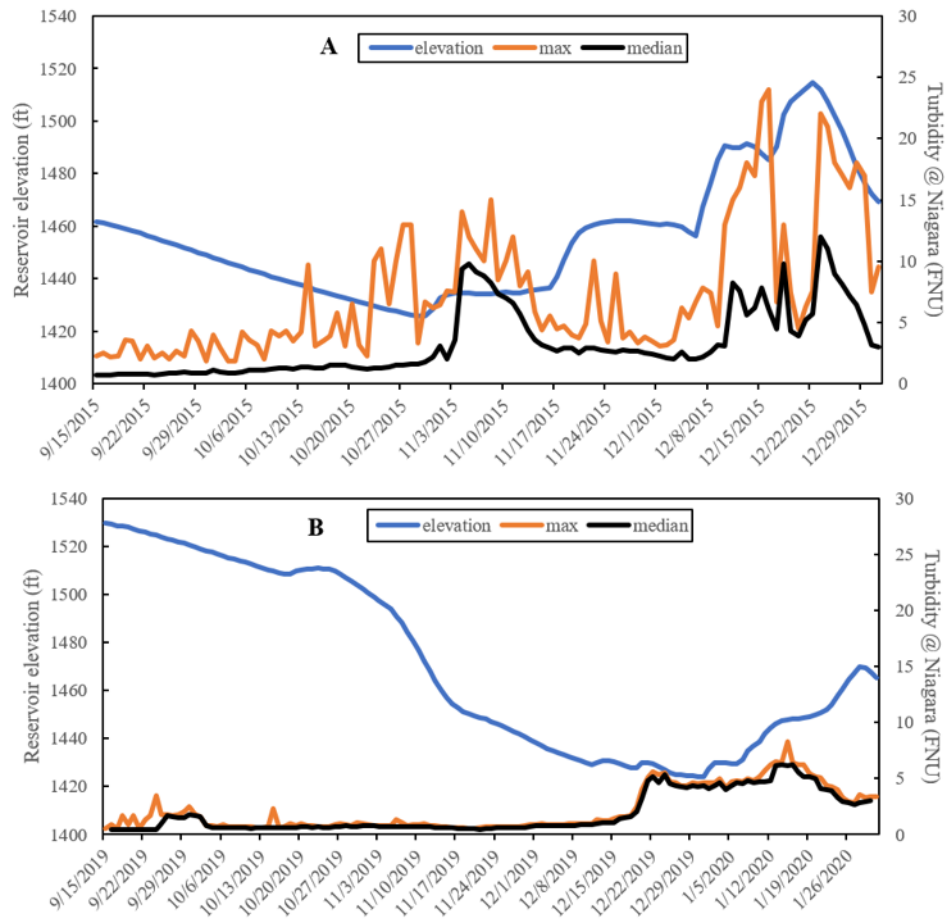


Figure 2. Daily maximum and daily median turbidity levels in the North Santiam River at Niagara during drawdowns of Detroit Reservoir to 1,425 ft. elevation in 2015 (A) and 2019 (B). Note longer time scale in panel B. Reservoir elevation data are from U.S.G.S. station 14180500 at Detroit Dam and turbidity data are from U.S.G.S. station 14181500 at Niagara.

33. In contrast to the low turbidity levels at Niagara during the 2015 and 2019 drawdowns, turbidity has been much higher downstream in the vicinity of Geren Island and the City of Salem water treatment facility since monitoring began in September 2020. The daily maximum turbidity recorded about 4.5 miles upstream of Geren Island exceeded 50 FNU on 26 occasions, and exceeded 330 FNU three times (data from USGS North Santiam River station

14183020). Daily median levels have exceeded 50 FNU on five occasions, with levels over 140 FNU two times. The high turbidity levels were generally associated with rain events in November and December as well as in February–April. The North Santiam River experiences high turbidity levels from different sources throughout the watershed including landslides and runoff during high rainfall events from various land uses such as forestry (harvest and roads), agriculture, and urban/industrial, but the Little North Santiam River has been identified as a major source of sediment recorded in the North Santiam River downstream near Stayton. The Little North Santiam River enters the main North Santiam River 0.5 miles above the town of Mehama, 19 miles downriver of Big Cliff Dam.

34. High turbidity levels at Gerren Island near Stayton have historically been caused more by suspended sediment from the Little North Santiam River rather than by sediment generated upstream of Mehama on the North Santiam River (Sobieszczyk et al. 2007; Bragg and Uhrich 2010; Piatt et al. 2011). For example, in the 2007 water year (a high flow year), the percent of turbidity values > 50 FNU was greater than in prior years at most monitoring stations, but the Little North Santiam River near Mehama exceeded 50 FNU more than other stations, and turbidity values at the Little North Fork station and at the Mehama station (below Little North Fork confluence) were as much as an order of magnitude higher than at the Niagara station downstream of Big Cliff Dam (Piatt et al. 2011). During 2005–2008 water years, two-thirds of sediment measured in the North Santiam River near Gerren Island originated in the Little North Santiam River subbasin (Bragg and Uhrich 2010). The volume of clay-water (persistently turbid water) was higher in the Little North Santiam River in water years 1999–2004 than at all other monitoring stations in the North Santiam watershed (Sobieszczyk et al. 2007). In other words, high turbidity events in the North Santiam River have occurred on numerous occasions in the

recent past as a result of natural and human-caused events, and a major source appears to be the Little North Fork Santiam River.

35. Any effects in the North Santiam River downstream of Detroit Dam from the fall drawdown are likely to be much less than that experienced in the South Santiam River after the 2023 Green Peter drawdown for several reasons: A) the Detroit drawdown would be proportionally smaller than the Green Peter drawdown relative to the size of the reservoir, thus potentially mobilizing a smaller amount of sediment (*see* Corps SEIS information sheet⁹); B) drawdown at Detroit will take an incremental approach coupled with real time turbidity monitoring (ROD for SEIS, pp. 12–13); C) the Detroit reservoir has been drawn down to the proposed level of 1,425 ft twice in the past eleven years without creating a high level of sedimentation (*see* ¶ 32), and accumulations of sediment that would be exposed would be far less than newly exposed sediment in the Green Peter drawdown; and D) South Santiam median turbidity levels at the Waterloo station in 2024 were about 30% lower than in 2023 and duration was 53% lower in 2024 (data from USGS station 14187500; 14 miles below Foster Dam and 20 miles below Green Peter Dam). The decrease in the second year of the drawdown was likely a result of lower precipitation in fall during the drawdown, less sediment exposure because of an altered drawdown schedule, and reduction of reservoir sediment after the first drawdown (2024 BiOp, p. 5.5-410–412). During the deep drawdown of Cougar reservoir to construct the temperature control tower (April 2002–December 2004), the measured sediment load downstream in the South Fork McKenzie River decreased 36% after the first year and 62% after the second year (Anderson 2007).

⁹ Supplemental EIS information:

https://publibrary.sec.usace.army.mil/api/download?id=6d06c15d-6d2d-4b55-f961-05ac3850292a&filename=WVS_FAQs_Comprehensive.pdf&preview=true

Downstream Sediment Effects on Salmon

36. Fine suspended sediments can affect salmonid spawning and incubation success and juvenile growth and survival (e.g., Bash et al. 2001; Jensen et al. 2008)). Turbidity levels of 50–70 NTU (NTU is generally similar to FNU) have been reported to affect salmonid behavior such as foraging and can cause damage to gills. Effects on newly emerged salmonids have been reported at 25–50 NTU. Some studies have shown that juvenile Chinook salmon and steelhead appear to prefer feeding in slight to moderate turbid water, likely as a tradeoff between foraging at lower efficiency but with a reduced risk of predation (reviewed in Bash et al. 2001). Factors affecting how suspended sediment might affect salmon redds and juvenile salmon include duration of events, river bed composition, and gradient. Characteristics such as groundwater upwelling and river morphology (meanders, side channels, near-shore shallow habitat) can provide refuge from elevated levels of suspended sediment (Bash et al. 2001; Zimmerman and Lapointe 2005; Tritthart et al. 2019). Effects of sediment on fish can be relatively short-term, and sedimentation events do occur frequently during high water events in salmon-bearing rivers of western Oregon. Over a longer time scale, the disturbance of river bed substrate caused by salmon digging redds cleans fine sediments from gravel (e.g., Moore et al. 2004).

37. ODFW sampled the South Santiam River following the 2023 Green Peter drawdown to evaluate the potential effect of high sediment levels on redds, egg development, and early rearing of juvenile salmon. Three sites were sampled: Waterloo, Gills Landing at Lebanon, and Highway 226 Bridge, about 14 miles, 19 miles, and 30 miles downstream of Foster Dam, respectively. Juvenile spring Chinook were captured with nets at all sites with minimal effort, and almost 300 fish were caught in total. The sizes of the juvenile salmon and capture rates were similar to that in previous years of sampling the South Santiam River, indicating little

effect of the sedimentation event on spawning and early rearing. During the deep drawdown of Cougar reservoir in 2002–2004, sediment was released into the South Fork McKenzie River with some carried into the McKenzie River downstream of the South Fork confluence (Anderson 2007). The mean number of spawners in the South Fork McKenzie was slightly lower (233) for returns of fish exposed to the high sediment loads than for fish that spawned and reared in years before the drawdown (248), suggesting a small effect on spawning and rearing in this tributary. However, the number of spawners counted in the McKenzie River downstream of the South Fork confluence was unchanged between the drawdown years and the pre-drawdown years. Although many factors can affect returns of adult salmon, these data indicate the effects of high levels of sediment in the South Fork McKenzie from the Cougar deep drawdown did not have a major or lasting effect on Chinook salmon spawning and rearing either in the South Fork or in areas of the McKenzie River downstream of the South Fork.

Responses to Amerman and Rumreich Declarations

38. Generally, Amerman and Rumreich contend the drawdown of Detroit Reservoir will cause “irreparable harm” to listed Chinook salmon and steelhead but provide little data or documentation to back up these claims. Amerman contends a drawdown at Detroit Reservoir will harm protected species, citing as evidence the drawdown at Green Peter reservoir and that “...fish could not survive the turbidity that resulted” (Amerman Decl. ¶ 13). Amerman also cites a low percentage of wild Chinook salmon in 2026 (apparently in the fish count at Willamette Falls) as evidence the 2023 Green Peter drawdown and resulting sedimentation harmed protected fish populations (Amerman Decl. ¶ 12).

39. First, the proposed drawdown at Detroit Dam is likely to have a minor effect on sedimentation in the North Santiam River (*see* ¶¶ 32 and 34; SEIS Chapter 2, p. 19). Secondly,

the size and number of juvenile fish captured with minimal effort in the South Santiam after the 2023 Green Peter drawdown indicated little effect of higher sediment loads on salmon (§ 37; *see* also data from Cougar reservoir deep drawdown in 2002–2004). Finally, about 90% of adult salmon returning to the South Santiam River in 2026 would be age 4 and 5 based on the 2002–2020 average age composition; therefore, return numbers in 2026 would be affected largely by freshwater conditions in 2021 and 2022, rather than those of 2023.

Conclusion

40. Measures such as the deep drawdown in the fall have been identified in the 2024 BiOp and are needed to improve the status of the listed UWR Chinook salmon and steelhead populations, including the North Santiam populations. The prospect for recovering and delisting the North Santiam populations, and the UWR ESUs, is jeopardized because of declining trends in abundance and productivity. Restoring access to historic spawning and rearing habitat in the upper watershed has been identified as a key measure to reducing risk to the North Santiam salmon and steelhead populations, which will require safe and effective downstream passage for juvenile fish through the dams.

41. Juvenile salmon that migrate downstream in the fall are part of the life history portfolio in UWR populations that contributes to the stability and resilience for the species. Fall migrants make an important contribution to the total number of yearling smolts, and yearling smolts are the largest contributor to adult returns in populations that are more successful than the North Santiam population, such as the McKenzie, Clackamas and Sandy populations (which have adult returns 3–3.5 times higher than North Santiam population). Construction of the North Santiam dams blocked access to the upper watershed and changed the life history composition of the Chinook salmon population: the proportion of yearlings in adult returns to the North Santiam

is about 40% lower than in the Willamette population as a whole before dam construction.

Increasing the number of fall migrants by providing safe and effective passage at the dams is important to increase the life history diversity of the North Santiam population and is critical for increasing the survival and recovery of the species.

42. The fall drawdown of Detroit reservoir is expected to benefit Chinook salmon because of increased passage efficiency and survival by providing passage through RO routes instead of the powerhouse route. A deep drawdown in the fall is currently the only available means of providing safe and effective passage for fall migrants. A deep drawdown is necessary to decrease the depth of water above the RO so that juvenile salmon can sound and locate the RO for passage. In addition, the fall drawdown is expected to provide benefits because a decrease in reservoir volume would reduce travel times for fish migrating through the reservoir, and would lower risks from predation and disease (SEIS Chapter 3, p. 125).

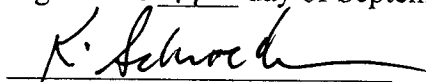
43. Winter steelhead have not been outplanted upstream of Detroit Dam because the population is entirely wild and abundance is too low to risk the high mortality of juveniles attempting to pass the dams under current operational conditions. Improvement in passage effectiveness and safety would allow winter steelhead to be reintroduced into high-quality spawning and rearing habitat upstream of Detroit reservoir.

44. Finally, a volitional passage measure is needed now because the status of the North Santiam salmon and steelhead populations is precarious, with both experiencing a long-term decline in adult returns and productivity. Measures must be implemented now because it is likely that a structural, long-term solution will take a decade or more to be completed, if it ever is. A fall drawdown as a downstream passage measure has been identified for at least 18 years,

and additional delay in implementing this measure will only increase the jeopardy to the listed salmon and steelhead populations.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Signed this 17 day of September, 2026 in Philomath, Oregon.


Kirk Schroeder

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Addendum: Kirk Schroeder experience and expertise

1. I received a Bachelor of Science (B.S.) from the University of Idaho in 1975 and have over 40 years of experience conducting research and monitoring on salmon and steelhead, including 36 years with the Oregon Department of Fish and Wildlife (“ODFW”) conducting studies, evaluating management actions, and providing management recommendations. I served as the Research Project Leader on the Willamette Spring Chinook Research Project from 2004 to 2013 and was an Assistant Project Leader from 1996–2004. I retired from ODFW as a Research Project Leader in 2013 and continued to work part-time on advising the project and writing research papers. My principal job responsibilities at ODFW included the development and

implementation of research on the life history and habitat use of spring Chinook in the Willamette and Sandy basins to provide information for protecting and recovering populations, analysis and writing of research results, coordination with ODFW management, presentation of research results at agency, interagency, and professional meetings, coordination with state and federal agencies, and collaboration with scientists from Oregon State University, University of Oregon, and Oregon Watershed Enhancement Board.

2. I have worked with spring Chinook salmon on numerous rivers including the Salmon and Middle Fork Salmon Rivers in Idaho and the Deschutes, Warm Springs, John Day, McKenzie, North and South Santiam, Clackamas, and Sandy Rivers in Oregon. I also worked on studies of winter steelhead on Oregon coastal rivers, including acclimation studies of winter steelhead in the Siuslaw River and studies on reducing stray hatchery fish in coastal rivers. My experience includes extensive spawning ground surveys, design and implementation of research studies, and development of management plans. I have conducted research and monitoring studies on numerous aspects including status and trends of natural populations, life history diversity and population stability, effect of catch-and-release fisheries on spring Chinook salmon, composition of hatchery-wild fish in spawning populations, strategies to reduce hatchery strays, and hatchery fish release strategies.

3. I helped design and implement a broad set of research activities for ODFW starting in 1996 that included intensive spawning surveys and collection of biological data, juvenile fish sampling and tagging in spawning tributaries and in the mainstem Willamette River to identify migratory behavior, a research study of the effects of catch-and-release fishing in the lower Willamette River, and a marking program that enabled fish managers to identify and manage wild and hatchery Chinook salmon (this included a hatchery-wide fin clipping program

and thermal marking of otoliths to differentiate unclipped hatchery fish from wild fish in carcasses collected on spawning grounds). I have extensive knowledge of streams and rivers in the Willamette Basin while conducting adult and juvenile salmon surveys from 1996 through 2013. The results of our work were used to help develop conservation and recovery objectives for Upper Willamette River (“UWR”) Chinook salmon.

4. The results of our surveys have been published in a series of annual reports and scientific papers. Our work was the basis for a comprehensive research paper on the diversity of life histories in juvenile and adult Chinook salmon that demonstrated how diversity provides stability and resilience to salmon populations in the Willamette Basin. I have collaborated with university scientists to develop criteria and identify winter habitat for juvenile Chinook salmon in the Willamette River and adjacent floodplains. In addition to publications listed in References, a selected list of publications includes:

Whitman, L.D, R.K. Schroeder, and T.A. Friesen. 2017. Evaluating migration timing and habitat for juvenile Chinook salmon and winter steelhead in the mainstem Willamette River and major spawning tributaries. Task Order No. W9127N-16-P-0157. Final report to Army Corps of Engineers, Corvallis, OR.

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5. I have served on science and professional society committees including the Clackamas Science Review Team to assess the effects of PGE dam operations on salmon and steelhead populations, Chair of Natural Production Committee for the Oregon Chapter of the American Fisheries Society (“AFS”), President of Oregon AFS, Snake River Review Committee for Western Division AFS, and Resolutions Committee for AFS at the national level.

6. I have received awards and recognition for my work including Oregon AFS awards of Fishery Worker of the Year (1998), Award of Merit (1993), and Past-president (1996–1997), as well as ODFW awards of Biologist of the Year (2011, Northwest Region) and Technical Achievement Award (1997, Northwest Region).