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UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF OREGON

NORTHWEST ENVIRONMENTAL DEFENSE CENTER, **WILDEARTH GUARDIANS**, and **NATIVE FISH SOCIETY**,

Plaintiffs,

v.

U.S. ARMY CORPS OF ENGINEERS and **NATIONAL MARINE FISHERIES SERVICE**,

Defendants.

CITY OF SALEM and MARION COUNTY,

Intervenors.

Case No. 3:18-cv-00437-HZ

Third Declaration of Richard A. Domingue In Support of Plaintiffs' Request for Permanent Injunctive Relief

I, Richard A. Domingue, 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 was asked by the Plaintiffs in this litigation to provide my expert opinion on their request for injunctive relief to remedy the U.S. Army Corps of Engineers' ("Corps") failure to adopt meaningful protective measures to address the adverse effects of its Willamette Valley Project (WVP or Project) on threatened Upper Willamette River Chinook salmon and steelhead following NMFS' issuance of the 2008 Biological Opinion ("BiOp").[1]

3. Attached as Exhibit 1 is my resume and a summary of my professional experience and qualifications to provide this testimony. In brief, I have over 30 years of experience dealing with dam-related environmental issues. I worked for the National Marine Fisheries Service ("NMFS") as a Hydrologist in the Hydro and Oregon/Washington Coast Divisions of the Northwest Region for 20 years, where I was involved in drafting the 2008 BiOp and the Reasonable and Prudent Alternative ("RPA") and in the day-to-day operation of the Willamette Action Team for Ecosystem Management ("WATER") that was required under the BiOp. Overall, I worked on a wide range of technical, scientific, and biological issues, and detailed how the Corps' operation of the Willamette Project would affect ESA-listed Upper Willamette River Chinook and steelhead and their designated critical habitats.

[1] NMFS 2008 Endangered Species Act Section 7(a)(2) Consultation Biological Opinion & Magnuson-Stevens Fishery Conservation & Management Act Essential Fish Habitat Consultation. Consultation on the "Willamette River Basin Flood Control Project".

The Need for Injunctive Relief

4. By failing to implement the RPA in a timely manner, the Corps has extended the Project's adverse effects on UWR Chinook salmon and steelhead, further risking their survival and potential for recovery. Indeed, both species have recently further declined in abundance and that trend is likely to continue. The Corps has discretion to make operational or maintenance decisions that could reduce Project impacts on the fish, but often prioritizes other uses, like hydropower or recreation, instead.[2]

5. The WVP continues to present an array of issues impacting fish survival and the viability of the species, including:

Passage: Lack of adequate passage through the dams and reservoirs is limiting the potential for species recovery. Indeed, recent species status review (NMFS 2016) and the recovery plan for the species (NMFS and ODFW 2011) focus on the need for improved juvenile passage through the WVP to move UWR Chinook salmon and steelhead toward species viability and recovery. Currently, returning adult spawners are captured downstream from Big Cliff, Foster, Cougar, and Dexter dams and either released to the river, trucked to hatcheries, or trucked to release sites upstream from the reservoirs. Very little is done to improve the downstream migration of juveniles or post-spawning steelhead (aka kelts). Juvenile Chinook salmon and steelhead often spend weeks to months in Project reservoirs where they are exposed to predation and disease before locating a dam outlet and passing the dam. A substantial fraction of juveniles that enter the reservoirs never leave, indicating they perished there. At present, there are no juvenile fish collection and passage systems, effective over the range of operations,

[2] USACE, 2012. Willamette River Basin Operational Measures Evaluation Report, Final Report U.S. Army Corps of Engineers, Portland District.

currently in place at Project dams, and juveniles must pass through dam spillways, regulating outlets ("ROs"), or powerhouses to pass downstream to the ocean to complete their life-cycle. Passage through the Project's spillways and regulating outlets, though not ideal, provides higher passage survival than does passage through Project powerhouses. Substantial changes in dam operations to facilitate juvenile passage have only occurred at Fall Creek Dam, and that change—a deep drawdown of the reservoir to the level of the regulating outlets—has proven to be very successful.

Reservoir survival: Juveniles spend varying amounts of time in WVP reservoirs. Spring migrants, mostly 1-year old or older, tend to move through the reservoirs to the dams rapidly (days to weeks), while fall-winter migrants tend to linger, sometimes for several months. Project reservoirs harbor large populations of predatory fish that prey on Chinook and steelhead juveniles; and expose them to parasitic copepods that infect and kill both Chinook and steelhead juveniles. Chinook juveniles tend to have the highest rates and intensities of infection. Studies have shown (Monzyk 2015) that both the rate of infection (fraction of infected individuals in the population) and the intensity of infection (number of copepods living on a fish) increase with residence time in Project reservoirs.[3] The Corps' operation of the dams creates large, slackwater reservoirs that extend juvenile travel time through reservoirs and frequently traps juveniles once they reach the dams due to the limited passage opportunities. As a result, current project operations increase juveniles' exposure to predation and infection, limiting their survival.

[3] Fred R. Monzyk, Thomas A. Friesen & Jeremy D. Romer (2015) Infection of Juvenile Salmonids by Salmincola californiensis (Copepoda: Lernaeopodidae) in Reservoirs and Streams of the Willamette River Basin, Oregon, Transactions of the American Fisheries Society, 144:5, 891-902

Water temperature. The dams alter downstream water temperatures. By creating large, slackwater reservoirs the dams increase the water surface area exposed to solar radiation, increasing the heat entering the reservoir. The large storage reservoirs store this heat along with the water. The reservoirs also stratify during the summer, with warm water at the surface and cooler, denser water deeper in the reservoir. Project powerhouses pass water from deep in the reservoirs and thus discharge cooler than natural water in the summer. In the fall, this stratification breaks down and as the reservoirs are drafted to their winter flood season lows, warm water passes through the powerhouses and to the rivers below. These deviations from natural conditions decline in the downstream direction with the largest deviations and greatest effect on fish near the dams. There are both beneficial and adverse effects on fish caused by cooler temperature releases during the summer. They slightly expand the portion of the streams below the dams suitable for the fish by increasing the length of stream with suitable water temperatures (i.e. water temperatures below 68 ºF), but they also likely reduce the growth of juvenile Chinook salmon and steelhead and delay steelhead egg incubation and the emergence of steelhead fry nearer to the dams.[4] The large storage reservoirs also tend to release warm water well into the fall which accelerates the rate that incubating Chinook salmon eggs develop, leading to early fry emergence. Early emergence has been found to lead to poor juvenile survival and studies have shown that Chinook eggs incubated in warmer water tend to produce less well-developed fry. This poor survival could also be due to low levels of food available during the winter.

[4] UWR steelhead spawning and rearing is only affected by Project operations in the North Santiam and South Santiam Rivers.

TDG: Spill operations at the dams—when water is routed through the spillways or regulating outlets instead of through the turbines—increase the entrainment of atmospheric gasses into the receiving water, at times leading to total dissolved gas concentrations (TDG) well in excess of the state's standard of 110% of the saturation concentration, sometimes exceeding levels known to be harmful to fish (~125%). The highest levels of spill and TDG typically occur during the flood control season (~November through January) when the Corps often discharges water through Project spillways at high rates. High levels of TDG also occur when turbines are offline due to planned or unplanned outages or other reasons. When turbines are forced off during certain time periods—such as when fish are spawning below the dams—harm due to higher TDG levels is more likely. High levels of TDG can cause injury and death to affected fish. Harm to fish is associated with life-stage, along with the magnitude and duration of exposure. In other words, the effects on fish are more severe the higher the TDG levels and the longer the exposure. Fish display strong avoidance behavior to high TDG and will seek to move away. During spawning "moving away" means abandoning mating sites or redds, potentially reducing spawning success. During incubation, "moving away" is not possible and exposure lasts as long as elevated TDG levels persist. Incubating eggs and pre-emergent fry have been shown to be highly susceptible to injury and death due to elevated levels of TDG. Fish held in traps are also highly susceptible. TDG levels tend to decline in the downstream direction in turbulent streams as the water off-gasses, much like a shaken soda, and tend to remain high in more quiescent waters like reservoirs.

Pre-spawning mortality: There is a very large problem with adult pre-spawning mortality ("PSM") at the Project, particularly in the Middle Fork Willamette. A large fraction of adult Chinook salmon returning to the Willamette basin die prior to spawning. The causes of this

problem are not fully known but are thought to be associated with high water temperatures and/or disease. High rates of PSM have been observed in fish both downstream from Project reservoirs, where Project operations affect water temperatures, and in fish that were collected downstream from the dams and transported upstream of the reservoirs to release sites, where the streams are naturally cooler. This suggests that environmental conditions alone are not likely the primary cause of death, and that perhaps disease contracted prior to capture led to the high rates of PSM.

Instream flows: The storage and subsequent release of stored water alters downstream flows. A set of desired minimum downstream flows to protect fish uses was established in the 2008 BiOp. The Corps has been unable to meet these flow objectives as frequently as expected when modeled by the Corps for the BiOp. This is likely due to changing hydrologic conditions not considered when the BiOp was written (e.g. climate change) and the Corps' tendency to favor reservoir refill over meeting the spring steelhead spawning objective when conflicts occur.

6. In sum, lack of juvenile passage, reservoir conditions, pre-spawning mortality, and water quality and flows are the key types of harm to UWR Chinook salmon and steelhead that result from the Corps' operation of the WVP. This harm has occurred for years because the Corps did not, as it was required to under the 2008 BiOp, implement interim and permanent measures to reduce these types of harm. As a result, this harms continues today and is likely to continue absent significant changes to the Corps' operations, thereby threatening the survival and recovery of the species.

Summary of the Problems with the Corps' Interim Measures

7. The interim measures that the Corps has agreed to implement during its ongoing consultation with NMFS—as described in its June 2020 Interim Measure Implementation Plan

(IMIP)—are insufficient and disorganized. Most of the harms imposed by the Project would continue under the IMIP. The individual dam actions are mostly small, and unlikely to substantially increase dam passage survival. Overall, the IMIP lacks a systematic and system-wide approach to ensure that conditions significantly improve so these populations do not continue to decline or remain at perilously low numbers in the coming years. For example, the Corps proposes measures intended to increase juvenile passage survival at Hills Creek Dam, yet offers no remedy for the very poor juvenile survival at its Lookout Point Dam and reservoir downstream. Fish that successfully pass Hills Creek Dam would also have to pass through Lookout Point Dam and reservoir, where up to 80% would likely perish. This makes little sense. The modest increase in fish passage provided by the IMIP at Hills Creek would be mostly negated by the high mortality at Lookout Point.

8. Due to these and other limitations in the Corps' IMIP—which are described in detail below—stronger measures are needed to reduce the ongoing harm to species during the next several years while NMFS completes a new Biological Opinion for the WVP. The Plaintiffs' proposed measures are needed to reduce this harm and fill gaps in the Corps' IMIP.

9. Although some new information may be gleaned from IMIP operations, the deeper and longer drafts and spills proposed by the Plaintiffs would constitute new, experimental operations that would have a greater likelihood of improving fish survival while generating new information on the efficacy of modifying project operations to benefit fish. Thus, the Plaintiffs' proposed measures offer an opportunity to develop new information likely to be useful to devising future Project operations and to identifying the need, and operating criteria, for new facilities (e.g. juvenile fish collection facilities).

Summary of Benefits of the Plaintiffs' Proposed Interim Measures

10. Below, I provide my professional opinion on the likely effects of the Plaintiffs' proposed measures on fish passage, pre-spawning mortality, and water quality and quantity, and, where appropriate other Project uses. I base my professional opinion on scientific research in Project-affected reaches and elsewhere, and my professional experience with and knowledge of the Project and the fish.

11. A focus of the Plaintiffs' measures is improving fish passage, particularly juvenile fish passage through Project dams and reservoirs, which is currently poor at most Project dams. Juvenile fish passage through the Project's large, slow-flowing storage reservoirs and dams in the fishes' range (Hills Creek, Lookout Point, Fall Creek, Cougar, Green Peter, Foster and Detroit dams) is affected by the following concerns:

a. Lengthy passage times through reservoirs to dam outlets harms fish. The length of time between the fish's entrance to the reservoir and passage through the dam or outlet. This reservoir travel time is related to the velocity of water flowing through the reservoir, the length of the reservoir, and fish behavior. The larger the reservoir and the lower the flow through the reservoir, the slower the water velocity and the longer the reservoir travel time. Low flow velocities can lead to fish wandering in the reservoir as the downstream direction becomes harder for the fish to detect. Generally, fish navigate by following the flow of water. The longer the fish remain in the reservoir the greater their exposure to predation and disease. In general, the longer the fish are in the reservoir, the fewer that will survive to pass the dam. It should be noted that reservoir residence also increases the fish's growth rate as there is more food available in the reservoir than in the

river downstream. Larger fish are more susceptible to injury and death when passing through Project powerhouses. This tendency to remain, or 'residualize' in Project reservoirs also interferes with the fishes' normal life-cycle. The Plaintiffs' measures aim to reduce reservoir residence time by reducing the reservoir footprint through deeper drawdowns, where feasible, and by providing seasonal attraction to safer routes of passage. The Plaintiffs' measures also provide for passage during fall and spring, facilitating migration for multiple life-history forms and reducing time spent in the reservoir.

b. Fish struggle to find and safely pass the outlets under normal conditions. Because the fish tend to swim near the water surface during the spring, surface or near-surface discharge at the dams' spillways tends to pass most fish in the spring/early summer. While available evidence shows that juvenile salmon and steelhead swim deeper in these reservoirs during the summer, they mostly remain well above the dams' regulating outlets. Fish can dive to find deeper intakes but at depths over 40 feet, fish begin to have noticeable difficulty finding the outlets. Both penstocks (turbine intakes) and regulating outlets are located well below spillways, often well over 100 feet lower and are hard for the fish to find under normal operations. The Plaintiffs' proposed measures aim to pass more fish through the spillways when available, or through regulating outlets when spillways are not available, and to lessen the depth to which fish must dive to find the regulating outlet(s) when the reservoir water surface is below the spillway by lowering reservoir levels from fall to early spring. Juveniles move and pass Project dams mostly at night, often with the highest rate of dam passage in the

crepuscular hours of dawn and dusk, making providing safe passage during those hours particularly important.

c. Passage through Project powerhouses is unsafe. Turbine passage harms and kills fish from mechanical injury (termed strike), hydraulic shear stress, and the pressure change that takes place as highly pressurized water in the reservoir meets standard atmospheric pressure, or less, inside the turbine. The fish passage performance of turbines varies widely. Past study results have noted that Francis-style turbines, which are found at the Project's high-head dams (Detroit, Green Peter, Cougar, Lookout Point, and Hills Creek), tend to provide poor fish passage survival, generally from less than 50% survival to around 70% with smaller fish surviving better than large fish. [5] Passage survival through Kaplan-style turbines, which are employed at Big Cliff, Foster, and Dexter dams tends to be higher. Spillway and RO passage is generally much safer, with studies noting survival from the mid-80% range to the high 90%s. The Plaintiffs' proposed measures aim to reduce the fraction of juveniles that pass Project dams via their powerhouses and to pass more fish through spillways and ROs, which should improve survival.

d. Dam spillways and regulating outlets tend to be the safest routes of passage. However, releasing water in a plunging manner, as occurs at regulating outlets and spillways, tends to generate higher than normal concentrations of dissolved atmospheric gas in the receiving water and can lead to undesirable concentrations

[5] Hansen, A.C., Kock, T.J., and G.S, Hansen, 2017. Synthesis of downstream fish passage information at projects owned by the U.S. Army Corps of Engineers in the Willamette River Basin, Oregon: U.S. Biological Survey Open File Report 2017-1101, 118 p., https://doi.org/10.3133/ofr20171101.

of total dissolved gasses (TDG) and gas-bubble trauma in affected fish. This constraint on spillway and RO operation may limit their use in juvenile passage. The Plaintiffs' proposed interim measures would require the Corps to complete designs for spillway modifications where needed to reduce downstream TDG and to consult with the technical advisory team ("TAT") should the measures prescribed herein themselves cause unacceptable levels of TDG.

12. Other water quality problems from dam operations continue to harm fish. To remedy these problems, the Plaintiffs' measures also the Project's effects on fish downstream from the dams, including: water quantity (flow rates), water quality (temperature and TDG), and adult pre-spawning mortality.

13. The Corps has a poor track record of implementing operational and other measures to benefit fish. As a result, more information is needed about the effectiveness of different measures and impacts to fish to inform the next BiOp. Thus, to evaluate the effectiveness of these measures, the Plaintiffs propose expanding the Corps' research, monitoring, and evaluation program ("RME").

14. Similarly, the Plaintiffs also propose a technical advisory team ("TAT") to provide assessments of the measures undertaken, recommend changes where appropriate, and to evaluate additional measures.

15. Finally, to address the Corps' past problems with following the RPA and the recommendations of scientists, the Plaintiffs propose continued Court oversight.

16. In my professional opinion, the Plaintiffs' proposed measures are reasonable and implementable within the schedule specified, and are substantially more systematic and aggressive than the Corps' IMIP. Implementing these measures would likely result in measurable

improvements in juvenile passage survival, improve downstream water quantity and quality in ways beneficial to fish, and provide substantial new information on the efficacy of operational measures to improve UWR Chinook salmon and steelhead survival at the Project. Having been in this business for 30 years, I recognize that our understanding of the effects of dams on fish, and of measures designed to address those effects is constantly evolving, leading to a need for adaptive management. I see these measures as both a step on the road to species recovery and a source of valuable information.

Analysis of the Plaintiffs' Specific Proposed Measures

North Santiam River: Detroit-Big Cliff complex

17. *Detroit Dam and Lake*: Under current operations, juvenile fish passage survival through Detroit Lake and Dam is poor, dam operations create adverse water quality effects downstream (water temperature and TDG), and spring flow targets are not always met. Elevated water temperatures during Chinook egg incubation in the fall reduce Chinook salmon reproductive success and episodic spills cause TDG levels known to be harmful to the fish. The Corps has analyzed the possibility of installing a combined variable depth intake structure, and juvenile fish passage facility to improve water temperatures and safely pass downstream migrating fish (Corps 2019).[6] The Corps has not clearly demonstrated its intent to construct this project. Even if the Corps commits to constructing this facility, completion would be years away and interim measures are needed now to improve fish passage to further the establishment of

[6] Corps, 2019. Draft Environmental Impact Statement: Detroit dam downstream fish passage and temperature control, Willamette River basin, North Santiam River, Oregon U.S. Army Corps of Engineers, Portland District

self-sustaining populations upstream, while continuing the operational temperature control program.

18. Under its IMIP, the Corps will "modify Detroit Dam operations during the drawdown when fish passage rates are high, as follows: Once the reservoir elevation is less than 100 feet over the turbine intakes (elevation 1500 feet to 1450 feet), typically around November 1 through February 1, turbines will not be operated at Detroit Dam between 6:00 AM - 10:00 AM and 6:00 PM - 10:00 PM except for station service power. The Corps will manage discharge from Detroit Dam to reduce total dissolved gas (TDG) levels downstream of Big Cliff dam.

19. The Corps' measures would have limited benefits, so the Plaintiffs propose instead to: draw down Detroit Lake to below its minimum conservation pool (1450 feet) by November 1 and keep it below 1450 feet until December 1 to allow use of the lower RO for temperature control; and also from November 1 through February 1, use the upper RO to safely pass fish and turn off turbines during the hours of 4 pm to 8 am daily.

20. This measure is aimed at drafting Detroit Lake to a level where its lower regulating outlets can be used, allowing discharge of the coolest water available when Chinook salmon eggs are incubating in the North Santiam River downstream. By opening the upper ROs for 16 evening-through-morning hours during the peak of the fall and winter migration, the majority of winter outmigrating juvenile fish would pass through Detroit Dam's regulating outlets, which provide safe passage, rather than the turbines, which do not. This much safer route of passage is not available under current operations or the IMIP. Because passage survival through the ROs is much higher than passage survival through the Detroit powerhouse, this measure would improve the survival of juvenile Chinook salmon and steelhead that outmigrate

during the fall and would likely also benefit outmigrating adult steelhead kelts (adults that return to the sea after spawning).

21. The Plaintiffs' proposed measure would provide a 16-hour flow through the ROs from sunset to sunrise during the peak of drawdown, while the IMIP provides only an 8-hour (4 hours near dawn and 4 hours near dusk) RO spill regime. Juvenile fish movement and dam passage is highest from evening through morning. The Plaintiffs' longer duration of RO operation (compared to the IMIP duration) would increase fish attraction to the safe route of passage and increase the likelihood of dam passage during the fall outmigration. By providing flow to and through the ROs, greater attraction to these safer routes of passage would be increased, increasing the number of juveniles passing via these routes, reducing dam passage delay and increasing passage survival. This would improve attraction of fall outmigrants to the ROs and increase their survival through the dam compared to current operations or the IMIP. However, this operation would be more successful with a deeper drawdown that lowered the reservoir closer to the RO level, such as what the Plaintiffs' propose for Cougar and Lookout Point. The Plaintiffs have chosen not to propose a deep drawdown at Detroit out of concern for the City of Salem's drinking water supply.

22. By maintaining Detroit Lake below 1450 feet, operation of the lower ROs would be possible, providing cooler water in the fall when available, bringing the North Santiam River downstream closer to the natural water temperature regime, thereby reducing the tendency for early Chinook salmon fry emergence in the North Santiam River downstream and associated poor survival.

23. In addition, the Plaintiffs propose that the Detroit spillway be opened and release more than half the total discharge from 6P to 6A daily for 30 days in the spring/early summer

once Detroit Lake reaches an elevation of 1543 feet, which is two feet above the spillway crest.[7] This would provide a safer route of passage for fish that pass Detroit Dam in the spring than going through the powerhouse. Research has shown that up to 90 percent of the annual passage of juvenile Chinook salmon occurs during the spring and early summer and that spring migrants are strongly attracted to the dam's spillway when it is open (USGS 2017). By discharging more than half the water through the spillway, most fish will follow flow to the spillway rather than the powerhouse. It is expected that this measure would somewhat dovetail with existing summer spill operations for water temperature control.

24. By providing passage by way of Detroit Dam's spillway this measure would provide a safer route of passage than the powerhouse and substantially reduce passage delay by eliminating the need for the fish to dive to find the powerhouse penstock intakes, a far more lethal route of passage. The IMIP does not modify spring operations, so the Plaintiffs' measure would be a significant improvement when spring spill is available.

25. The Plaintiffs also propose that the TAT be consulted to determine whether the Corps should meet the downstream flow objectives for the North Santiam specified in the 2008 RPA, or store water to meet lake level objectives, like spill. Under current operations, spring flows for steelhead spawning are sometimes reduced below the 2008 BiOp flow target (1500 cfs) when projected storage would fail to meet other objectives, including spill to control downstream water temperatures. These conflicts tend to occur during low snowpack years, when following the current rule-curve refill trajectory while meeting the downstream flow targets would prevent Detroit Lake from refilling to desired levels in hydrologic model runs. Research has

[7] Passage studies (Hanson et al. 2017) at the nearby Detroit Dam have shown that an opening of 1.5 feet was the best opening tested. 2 feet over the crest allows such an opening.

demonstrated that there is a significant declining trend in snowpack in the Cascade Mountains, indicating that the probability of refilling Project reservoirs is also declining. This lack of adequate snowpack has increased the frequency such adjustments have been made in recent years and that trend is likely to continue.

26. This trend suggests that the frequency of conflicts between the provision of adequate flows for steelhead spawning and storing water to meet subsequent needs is unlikely to decrease. That is, these conflicts are likely to continue until structural water temperature control and juvenile fish passage is available, allowing temperature control and safe fish passage over a wide range of hydrologic conditions. In the interim, consulting with the TAT when making such choices would improve access to real-time information on fish use downstream from Big Cliff Dam and the likely effects of flow reduction on them. ODFW personnel are routinely on the river, participating in fish management, and are uniquely able to identify the likely effects of such adjustments. Engaging the TAT in the decision process would ensure that fish needs are fully considered in the Corps' operations.

27. After two years of operation under these measures, the Plaintiffs propose that the TAT, in consideration of the measured effects of the actions, determine whether such operations be continued or modified to better meet fish needs.

28. While the measures prescribed above are based on the best available information, they are generally of greater duration or would occur under different conditions than those that occurred during the research from which they were derived. That is, they are new experiments and the outcomes cannot be fully determined prior to implementation. Thorough evaluation of their effectiveness is expected to lead to identifying potentially more effective measures, a part of a continuously adaptive process toward minimizing the Project's adverse effects on the

species' survival and recovery. This iterative process was supposed to happen under the 2008 BiOp, but the Corps' failure to implement the RPA prevented much of this key information from being generated and being used to benefit fish.

29. Spilling water via the spillway and ROs generate elevated TDG in Big Cliff reservoir and the North Santiam River downstream. In the event that operations described above to increase juvenile passage through Detroit Dam's spillway and ROs themselves cause TDG levels to exceed state standards in the North Santiam downstream from Big Cliff Dam, the Corps should consult with the TAT to devise changes to the operation to alleviate the problem. High TDG as a result of spill at Big Cliff Dam is an ongoing problem. The Plaintiffs' proposed remedy for this problem is described below.

30. *Big Cliff Dam*: Production of high levels of TDG, caused by spilling water at Big Cliff Dam, is a substantial concern. High levels of TDG can cause injury and death to affected fish. Harm to fish is associated with life-stage, along with the magnitude and duration of exposure. In other words, the effects on fish are more severe the higher the TDG and the longer the exposure. Life-stages that cannot move away are the most exposed, such as incubating eggs and fish held in traps. Incubating eggs and pre-emergent fry have been shown to be highly susceptible to injury and death due to elevated levels of TDG. Adverse effects from high TDG are most likely in the river reach between Big Cliff Dam and the Minto fish trap, an area sometimes referred to as a wild fish sanctuary and available only to wild fish because returning hatchery fish are sorted out at the trap. High rates of spills at Big Cliff are most likely during the fall and winter flood control season, a period when Chinook eggs are incubating.

31. To reduce the production of high levels of TDG caused by operation of the Big Cliff Dam spillway, the Plaintiffs request that spills be spread across all gates at Big Cliff to the

maximum extent possible. Spreading the spill minimizes gas production, though at high levels of spill, high levels of TDG would continue to occur. The Plaintiffs also propose that when spawning and incubation of UWR Chinook salmon and steelhead is occurring in the North Santiam River downstream from Big Cliff, the Corps avoid operations that would result in TDG exceeding the state standard in spawning areas unless necessary for flood control.

32. Operating the dam in an attempt to minimize high levels of TDG by spreading spill is a necessary interim measure. Avoiding spill rates that would cause TDG levels to exceed 110% of saturation during spawning and incubation to the maximum extent practical is needed to protect reproductive success of the fish in the North Santiam downstream from the project, particularly Chinook salmon that spawn near the dam.

33. While the above interim measures are needed to reduce the adverse effects of Big Cliff spillway operations over the near-term, a long-term solution will require structural modification of the spillway. The installation of spillway modifications such as flip-lips, designed to reduce the entrainment of atmospheric gasses, would substantially reduce TDG levels downstream. This measure would also increase the amounts of water that could be safely spilled at both Detroit Dam and Big Cliff Dam, thereby increasing safe downstream fish passage while improving downstream water quality. It also would reduce the very high levels of gas produced episodically during the fall and winter flood-damage reduction season.

34. To expedite development of a permanent structural solution to the high TDG issue downstream from Big Cliff Dam, the Plaintiffs propose that, in cooperation with the Corps design team, the TAT assess alternative structural solutions, including a flip lip, to permanently lower the production of TDG at Big Cliff Dam, and select one for detailed design work by

December 2022. The TAT may seek input from other experts, such as fish passage engineers, for their assessment. The Corps will then complete the 60% Design Report by December 2023.

35. *North Santiam Conclusion*: By employing safer routes of passage over a longer period than provided by either current operations or under the IMIP, the Plaintiffs' proposal provides a better opportunity to reduce the ongoing harm to the North Santiam populations of UWR Chinook salmon and steelhead than the Corps' IMIP. And, by spreading spills at Big Cliff Dam to reduce TDG production, and by facilitating use of the lower ROs at Detroit to reduce fall water temperatures downstream, the Plaintiffs' measures would reduce the Detroit/Big Cliff complex's adverse effects on downstream water quality as they limit fish use. I conclude that implementing these interim measures proposed by the Plaintiffs would likely benefit the species and that in the aggregate implementing these measures would likely improve the viability of the North Santiam River populations of both UWR Chinook salmon and steelhead.

South Santiam River: Green Peter-Foster Complex

36. Foster and Green Peter dams block access to and inundate spawning and rearing habitat in the upper South Santiam subbasin, an area that historically produced an estimated 85% of the spring Chinook and about 70% of the steelhead that returned to the South Santiam River. Volitional upstream fish passage in the South Santiam subbasin ends at Foster Dam. Returning adult salmon and steelhead are collected at the Foster fish facility, sorted and the wild fish transported to release sites upstream of Foster on the South Santiam. The Foster fish facility was recently rebuilt to improve collection and sorting efficiency and to reduce fish stress. It is used for year-round adult fish collection of winter steelhead, summer steelhead, and spring Chinook salmon. All unmarked adult spring Chinook and winter steelhead are transported to release sites upstream of Foster dam. Currently, no adults are released upstream of Green Peter reservoir.

37. Research on juvenile salmon and steelhead passage from spawning and rearing habitat upstream of Green Peter reservoir, through the reservoir and Green Peter dam shows very poor survival. Because of this, transporting adult fish past the dam was discontinued in 1988, leaving this habitat and its productive potential unused today. The Corps has evaluated juvenile passage system alternatives, but has not proposed to construct one at this time.

38. Research on juvenile passage survival at Foster dam has yielded somewhat conflicting results indicating excellent to poor performance, depending on the time of year and route of passage taken through the dam. Passage times through the reservoir vary, with very short passage times (a few days) under low reservoir levels in the winter to several weeks when water levels are high. Even though travel times through Foster reservoir are fairly low, about half of the fish that pass Foster dam are infected with parasitic copepods. The distribution of fish passage by routes (powerhouse, spillway, weir) varies by species and life-stage, reservoir level, and operations. Studies have shown that turbines were the predominant passage route under various operating conditions (Hughes and others, 2014). Spillway passage routes were available during several parts of the study when turbines were concurrently operating, but 78–90 percent of the fish passed through the turbines.

39. Following passage, fish may be exposed to adverse TDG conditions in the river downstream caused by spill at Foster dam. The river immediately downstream from the dam is the most impacted as TDG concentrations decline in the downstream direction. However, salmon spawning is also concentrated in the first 2 miles below the dam.

40. Although Foster dam passage performance is generally poor, a recent study (O'Malley et al. 2017) has shown that UWR Chinook salmon from the upper South Santiam watershed display sufficient reproductive success in some years to sustain themselves, albeit

with the help of the trap and haul system for adults. [8]Although the abundance of UWR Chinook salmon has declined precipitously since those data were collected, this whiff of success while downstream dam passage conditions and periodic downstream water quality conditions remain adverse to fish survival, the potential for further population expansion through passage and water quality improvement is obvious.

41. *Green Peter Dam and Reservoir:* The Corps' IMIP includes the following measure: "In 2020, the Corps, in conjunction with the WATER technical teams, will develop an initial RM&E plan using existing information to assess the potential for upstream and downstream fish passage in the Middle Santiam River. The RM&E plan would be used to inform future decisions regarding RM&E and fish passage, including the possibility of rebuilding the juvenile fish bypass system at Green Peter Dam." (IMIP)

42. The IMIP lacks any commitment to re-establish Chinook salmon and steelhead populations upstream of Green Peter Dam, preferring instead to study the potential for passage. The Plaintiffs propose instead that the Corps begin releasing adult Chinook salmon and steelhead into the Middle Santiam River upstream of Green Peter reservoir within one year and within two years: (1) design and construct two permanent adult release sites along Quartzville Creek, (2) repair the adult release site on the South Santiam at River Bend Campground, and (3) design and construct up to two permanent adult release sites on the Middle Fork Santiam River.

43. The Plaintiffs' proposal would begin the process of restoring fish access to historically very productive habitat in the Middle Santiam River and Quartzville Creek upstream

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[8] O'Malley, K.G., A.N. Black, M.A. Johnson, D. Jacobson. 2017. Population productivity of spring Chinook salmon reintroduced above Foster Dam on the South Santiam River. Prepared by: Oregon State University, Dept of Fisheries and Wildlife, Coastal Oregon Marine Experiment Station. Prepared for: U.S. Army Corps of Engineers, Portland District.

of Green Peter Dam as well as make needed improvements at an existing adult release site on the South Santiam. Due to the recognized importance of salmon and steelhead habitat upstream, Green Peter was initially constructed with a juvenile fish passage system, termed fish horns. This system largely failed to attract and safely pass a sufficient number of fish and was abandoned in 1987.

44. Due to this failure there are now no salmon or steelhead upstream of Green Peter Dam and very little research on juvenile fish movement through the reservoir and dam passage has been conducted recently. Data from the nearby and similar Detroit Lake shows that juvenile salmon sometimes tend to wander in the slow-moving reservoir, failing to recognize downstream from upstream. At full pool, Green Peter reservoir is 10 miles long, and the powerhouse operates as a power-peaking plant, meaning there are many hours with no or very little flow through the reservoir and dam, further confusing the downstream direction. This suggests that in order to pass fish at Green Peter Dam a smaller reservoir footprint and/or substantially larger and longer attraction flows would be needed.

45. The IMIP does not include any operational changes at Green Peter Dam, in keeping with its focus on further studying fish passage at the dam, rather than actions to reintroduce and pass fish.

46. The Plaintiffs propose instead that during the spring following the outplanting of adult salmon and steelhead upstream of Green Peter Dam, the Corps begin spring spill operations. During the spring refill, once the reservoir reaches 970 feet (2 feet above spillway crest), operate the spillway on a 24-hour basis for thirty days at a rate that is at least ½ of the daily average outflow, and open the upper fish horn during that time.

47. The Plaintiffs also propose that during the annual fall drawdown, when the reservoir elevation is within 40 feet of a fish horn, the Corps open that fish horn until the reservoir drops below it.

48. By reintroducing adult salmon and steelhead into the Middle Santiam River upstream of Green Peter reservoir in the first year and beginning operations designed to pass juvenile fish the next spring when the progeny of the spawners planted in the first year begin their sea-ward migration, the Plaintiffs' proposed measures begin the process of restoring the fish to their native habitats upstream of Green Peter Dam—an important step for recovery of these populations. The large, continuous discharge through the spillway during the spring would provide a strong flow signal to migrating juvenile fish, unlike the discontinuous flow provided by current power-peaking operations, and would attract fish to pass through the dam's spillway or the upper fish horn, not its powerplant, improving dam passage survival. Due to past failures at passing juvenile fish at the project and lack of subsequent research, it is uncertain how effective the Plaintiffs' passage proposal will be. For this reason, it would be prudent to simultaneously develop and analyze more aggressive operational measures as described below.

49. The Plaintiffs recommend that the Corps conduct operations at Green Peter Dam to improve downstream water temperatures and meet flow targets. This would entail spilling water during the summer to avoid storing too much heat in the reservoir, making it hard to reach fall temperature targets; and using the regulating outlets to release cooler water when desired in the fall. This measure would help to reduce the unnaturally warm water temperatures downstream from Foster Dam during the fall, thereby reducing the tendency for early emergence and poor survival of Chinook fry in the South Santiam River.

50. The Plaintiffs also propose that within one year, the Corps evaluate alternative downstream passage operations, such as deep drawdown and/or delayed refill of the reservoir, and provide results to the TAT and the WATER team. After two years of implementation of the interim measures and the collection of fish response data, the WATER/TAT will recommend whether to continue, or modify the measures described above. This measure is in keeping with an adaptive management approach aimed at furthering the survival and potential for recovery of the species.

51. *Foster Dam and Reservoir:* The Plaintiffs propose that by December 2022, the Corps provide the TAT a design review of structural options to improve fish passage (including fixing the current fish weir) and work with the TAT to select a preferred option. By December 2023, the Corps will complete the 60% design documentation report (DDR) for the selected option.

52. Under current operations, a large fraction of fish that pass Foster Dam do so via the powerhouse, the least safe route of passage.[9] Providing a safer route of passage that attracts more fish is needed. Defining a solution requires the development and evaluation of options and may include operational changes as well as structural modifications to the dam, such as modifying the fish weir.

53. The Corps' IMIP Action 9 states: "Beginning in fall 2020, the Corps will conduct an operation at Foster Dam during fall and spring months. The Corps will operate the spillway from 7:00 PM to 7:00 AM from October 1 - December 15 and March 1 - June 15. From 7:00 PM to 7:00 AM during that timeframe, the turbines will be operated at limited capacity for station

[9] Available data on passage survival by route varies widely (Hansen et al. 2017). Not all studies found the lowest survival through the turbines, but most did.

service power only. The Corps will coordinate this operation with Measure 10 to ensure that the needs of adult and juvenile salmonids are balanced."

54. The Plaintiffs' proposed measure covers these same dates but expands the hours of spillway/weir operation to 4P to 8A during October 1–December 15 so it lasts from sunset to sunrise during that time of year. This measure would provide safer passage to outmigrating juveniles for the full nighttime period. Some passage studies at Foster Dam have shown that most passage occurs at night, while others show passage at all hours through the powerhouse. Extending the hours of spillway operation in the fall would allow more fish to pass via the spillway than would occur when powerhouse operation is prioritized.

55. The Plaintiffs propose the Corps operate Foster Dam to maintain the reservoir at or below its minimum conservation pool elevation (613 feet) from the date when that elevation is achieved in the fall, nominally November 15, through May 15. Under current operations, the Corps begins to refill Foster reservoir on February 1, aiming to refill the lake by the first week in May. This enlarges the reservoir footprint during the peak of outmigration and reduces the velocity of water flowing through the reservoir.[10] Passage survival via the fish weir has also been found to be highest at low pool elevations. This measure would benefit a large fraction of the annual outmigration by speeding the trip through the reservoir and improving passage success, particularly during March through May 15 when spillway operation is prioritized over power generation.

[10] Outmigration timing has varied widely over the years with most years displaying a clear peak from January through May.

56. The Plaintiffs also propose measures to improve water quality by spreading spill across gates to reduce TDG and conducting operations to better achieve temperature targets. The IMIP contains no such measures.

57. After monitoring the results of the above actions for two years, the TAT will decide whether to continue the same operations or implement alternative operations. The TAT is specifically intended to provide such advice by providing direct communication with field personnel through ODFW and the experience and expertise provided by NMFS and Plaintiff-selected experts. The Corps' too-easy rejection of protective measures recommended in the past (OMET 2012) demonstrates a greater interest in protecting the status quo, which has been bad for fish, over implementing prudent protective measures.

58. *South Santiam conclusion*: By planting UWR Chinook and steelhead adults upstream of Green Peter Dam in the first year and testing operational changes at the dam in the second year, the Plaintiffs' measures offer concrete steps to reintroduce salmon and steelhead above the dam and improve juvenile downstream passage. The Corps' IMIP offers to further study reintroduction upstream of Green Peter Dam while the Plaintiffs' measures begin the process of re-establishing the fish to their historical habitat immediately. Maintaining lower reservoir levels at Foster into the spring will accelerate passage and using the spillways with no turbine use from sunset to sunrise during prime migration seasons will improve dam passage survival compared to current operations or under the IMIP. The Plaintiffs also propose measures to improve water quality below the dams, which are not included in the IMIP. The Plaintiffs' proposal provides a better opportunity to increase abundance of fish using the South Santiam River and re-establish the Middle Santiam River populations of UWR Chinook salmon and steelhead. I conclude that implementing each of the interim measures proposed by the Plaintiffs

would likely benefit the species and that in aggregate implementing these measures would likely improve the viability of the South Santiam River populations of both UWR Chinook salmon and steelhead.

South Fork McKenzie River, Cougar Dam

59. *Cougar Dam and Reservoir:* Current downstream migrating juvenile fish passage through Cougar reservoir and dam is very poor. Downstream passage is only available through the powerhouse or through the dam's regulating outlet. The emergency spillway is not used under normal operations. Under recent operations, fewer than 20% of the Chinook salmon juveniles that enter Cougar reservoir survive reservoir and dam passage. Fish from streams upstream of Cougar Dam pass through the upper portion of the reservoir fairly quickly until they encounter the slow, deep area near the dam. One study found that the median time for dam passage for juvenile Chinook salmon released near the head of the reservoir in 2011 was over 100 days. (Beeman et al. 2012). Copepod infestations of juvenile Chinook are severe and worsen with the fish's residence time in the reservoir. Only about 20 percent of the fish that approach the dam successfully pass it, mostly by way of the dam's ROs. The rest likely residualize or perish. Currently, the larger fraction of juveniles enters the reservoir during the late winter and spring, while the majority of fish pass the dam in the fall, when the reservoir is actively being drawn down and early winter, when the reservoir is at its lowest level. Both the IMIP and the Plaintiffs' proposal include measures designed to improve juvenile fish passage.

60. The IMIP states: "In 2021, the Corps will limit refill of Cougar Reservoir to 1600 feet beginning February 1 and operate to achieve a reservoir elevation of 1570 feet on or before September 1. Once the reservoir is below 1570 feet to January 1, regulating outlet and turbine operations would follow Special Operations Request (SOR) 2019 and 2020 Table 1, recognizing

Table 1 is a concept only and actual operations will be developed by the Corps and managed on a real-time basis."

61. In addition to limiting refill to 1600 feet and dropping the reservoir level to 1570 feet by September 1, the Plaintiffs propose that the Corps drop the reservoir level to 1505 feet by November 15 and hold there until December 15, and turn off the turbines (prioritize the RO) during the drawdown when the reservoir reaches minimum conservation pool (1532 feet). After December 15, the reservoir would return to minimum conservation pool and hold there until May 1 unless the TAT recommends earlier refill to ensure enough water for late summer and fall temperature control operations. During the period from February 15 to June 1, the turbines would be off and the ROs operated from 6P to 7A.

62. The Plaintiffs' proposal is aimed at increasing attraction to and passage through the RO by prioritizing RO operation from November through June and by lowering the reservoir level from fall through early spring. Lowering the reservoir level would make the RO more easily accessible, particularly during the deep drawdown period of November 15-December 15 when the reservoir would be only about 25 feet above the RO intake (which is at 1479'). The RO is generally the safest route of passage. However, its operation is limited by its tendency to produce high TDG concentrations, particularly when operated at higher reservoir elevations when the RO produces a plunging spout of water. Under the Plaintiffs' proposal, TDG production would be controlled by holding the reservoir at lower levels, reducing the plunging nature of the ROs' discharge stream that occurs under higher reservoir levels. Thus, this measure would: accelerate fish movement toward and through the dam, reduce reservoir travel time, lessen copepod burdens, provide attraction to the dam's safest route of passage, allow fish to find the ROs more easily—especially during the one month deep drawdown—and provide a greater

opportunity for late winter and early spring migrants to quickly pass through the project, in keeping with their natural life-history. This would provide substantial improvements from the Corps' proposal that does not drop the reservoir level as low or for both the fall and spring seasons.

63. The Plaintiffs recognize that operation of the dam's ROs to pass fish may be limited by injury to fish from the RO spillway and high levels of TDG. They propose that within two years the Corps provide a fish-friendly coating of the RO chute to reduce fish injury and within four years implement actions to reduce the vertical plunge at the RO spillway to reduce the production of high TDG. As described above, spill through the RO, while safer for fish passage, generates high levels of TDG, particularly at higher reservoir levels. Currently, in order to control TDG downstream when operating the ROs, the Corps releases water through the powerhouse to dilute the effect. This discharge through the powerhouse entrains fish, killing about half of them. Modifying the RO spill channel in a manner that reduces TDG production would increase the potential use of the RO to pass fish thereby increasing juvenile passage survival.

64. The Plaintiffs propose that the Corps model a run of river operation with the ROs operated in full-open position and the reservoir held near the regulating outlet invert elevation except as may be needed to control downstream flooding, and provide the results to the TAT for consideration. Such an operation would minimize reservoir residence time for juvenile salmon, provide the easiest access to the safest route of passage, effectively maximizing juvenile passage success while continuing to provide downstream flood control benefits. Also, because water residence time in the reservoir would be very low, the Project's effects on downstream water

temperatures would be minimized, thereby benefitting adult spawning and reproductive success downstream.

65. The Plaintiffs propose that following two years of operation under the program described above and the monitoring of its effects, the TAT advise the Corps as to whether to continue the program as described or modify the program in light of the new information. While the measures described above are based on the best available science and are expected to demonstrate improvement in fish passage survival, they represent an experiment in an adaptive management framework. Evaluating the effectiveness of these measures and recommending improvements is a role the TAT is designed to play.

66. *McKenzie conclusion*: In the aggregate, I expect these measures to result in improved juvenile passage survival at Cougar Dam. By drafting the reservoir lower and keeping it lower for a longer time, the Plaintiffs' proposal would provide a smaller reservoir footprint and greater flow velocity through the reservoir than would be provided under current operations or the Corps' IMIP. This would shorten reservoir travel time for the fish, particularly those that enter in the fall and winter. Dropping the reservoir to within 25 feet of the ROs in the fall while turbines are off would provide attraction to and passage through the safest route available. In addition, keeping the reservoir at a low level and keeping turbines off from sunset to sunrise during the peak of outmigration would reduce the entrainment of outmigrating juveniles and passage through the powerhouse and encourage passage through the ROs. I conclude that the Plaintiffs' measures are reasonable, implementable, and likely to demonstrate a benefit to UWR Chinook salmon by improving downstream passage substantially greater than would occur under the IMIP.

Middle Fork Willamette River: Lookout Point-Dexter complex and Fall Creek

67. There are four Project dams in the Middle Fork Willamette River basin: three large storage reservoirs (Hills Creek, Fall Creek, and Lookout Point dams) and one re-regulating dam downstream from Lookout Point Dam, Dexter Dam. Hills Creek, Lookout Point, and Dexter dams have hydroelectric powerhouses. Fall Creek does not.

68. There are three overarching issues hindering Chinook salmon recovery in the Middle Fork basin: very high rates of copepod infection in juveniles that pass through the reservoirs; poor to non-existent juvenile passage at the dams except at Fall Creek Dam; and very high adult pre-spawning mortality, both below and upstream of Project dams. At present, "No operations are performed at Dexter, Lookout Point, or Hills Creek to support juvenile downstream fish passage."[11]

69. The Plaintiffs' proposal includes operations designed to address the latter two issues. Developing operations likely to reduce copepod infections awaits further research. The proposed deeper drafts and access to safer routes of passage are expected to increase juvenile passage survival. High rates of copepod infestations and predation by birds and fish in Middle Fork reservoirs limits the survival of juvenile salmon and the longer an individual juvenile remains in the reservoirs the higher the number of copepods on its body and the lower its chance of survival. By lowering water levels, the Plaintiffs' proposal would reduce the reservoir footprints, shortening the length of flatwater that fish would have to negotiate to find the dams

[11] USACE, 2020. Willamette Fish Operations Plan Willamette Valley Project. U.S. Army Corps of Engineers, Portland District at MFW 8.

and their outlets, and shortening reservoir travel time. By reducing the length of time migrating juveniles remain in the reservoir, and by providing a safe route of passage, these measures will increase juvenile survival. Investigating the timing and concentration of pathogen loads leaving Dexter Dam is expected to increase our understanding of the causes of high pre-spawning mortality, hopefully leading to identifying measures to reduce them. And using the RO at Lookout Point Dam in late summer and fall could help lower water temperatures that are normally far too warm at that time. These outcomes are expected to improve the viability of the Middle Fork Chinook population, which NMFS and ODFW have determined is critical to the persistence and recovery of the species.

70. *Lookout Point:* The Plaintiffs propose that the Corps operate the dam as follows:

- Begin draw down August 1, lower the reservoir to 750 feet by November 15 and hold until December 15.
- Begin using ROs August 15 for temperature control.
- Turn off turbines during the drawdown when the reservoir reaches minimum conservation pool (825').
- Prioritize refill of Lookout Point to maximize opportunity for spill in spring. When reservoir refills above 889' (2' above spillway) in spring, conduct free, ungated spill for 2-4 weeks. Maintain reservoir below 911' during this operation.
- Within one year, model other passage operations, including delayed refill and run-of-river operations, and provide results to the TAT and the WATER team.
- After monitoring the results of the above actions for two years, the TAT will decide whether to continue the same operations or implement alternative operations, such as testing delayed refill or run-of river operations.
- Within two years, the TAT will assess methods for reducing predators in Lookout Point Reservoir. Within four years, the Corps will implement recommended actions from the TAT.

71. By comparison, under its IMIP the Corps' measure for Lookout Point is to "operate spillway gates to provide surface spill in the spring and summer as long as hydrologic conditions can support the operation, with a total discharge to meet downstream flow targets. During this same period, the Corps will conduct spill operations at Dexter Dam daily from 6:00 PM to 10:00 PM and limit turbine operations unless total discharge results in high TDG and there is a need to reduce spillway flows." The IMIP offers no further measures to benefit juvenile passage through the Lookout Point/Dexter complex. The Plaintiffs' proposal offers much larger benefits to juvenile salmon passage, particularly by improving passage for fish that are unable to pass in the spring and summer or that would naturally pass in the fall.

72. By beginning the annual drawdown on August 1 rather than September 1 as prescribed by the current rule curve, the deeper drawdown to 750' (compared to the normal fall drawdown to 825) could be accomplished without creating an undesirably high rate of drafting and high TDG downstream from Dexter Dam.

73. By drawing down the reservoir to 750 feet by November 15 and holding it there until December 15, the Plaintiffs' proposal would make the ROs, located at elevation 730 feet, very easy for the fish to find and safely pass. This deep drawdown would create very strong attraction to the ROs and 100% of the juvenile salmon passing during this period would pass through the ROs as 750 feet is below the penstock intake, making power generation impossible. This measure would provide a very large improvement in juvenile survival for fish migrating from upstream areas through Lookout Point Dam and reservoir during this period.

74. Based on experience from the nearby Fall Creek Dam where water levels have been dropped to the RO for several years, there are likely to be additional effects from this action. For at least the first year, there would be a significant turbidity effect. The short-term

high turbidity discharge from the dam is unlikely to have an adverse effect on the downstream aquatic environment. The large-scale movement of bedload (sediment that is too large to be suspended in the water column and moves along the channel bottom) experienced at Fall Creek would not happen because the Lookout Point ROs are well above the bottom of the dam, but bedload movement within Lookout Point Reservoir is expected. More importantly, other residents of the reservoir would likely be entrained and passed through the dam, displaced, or killed by the drawdown. At Fall Creek virtually all of the crappies—a fish-eating non-native sunfish species—were eradicated by the drawdown. Because a sizeable reservoir would remain behind Lookout Point Dam under the Plaintiffs' proposed measure, unlike the Fall Creek drawdown that completely drained the reservoir, it is unlikely crappies or other fish-eating fish could be eliminated by this measure alone, but it is likely their populations would be reduced. This would reduce predation on juvenile salmon, further benefitting the species.

75. The Plaintiffs propose that the Corps begin operating the Lookout Point Dam's ROs by August 15 each year to reduce water temperatures in the Middle Fork Willamette River downstream from Dexter Dam. Unnaturally warm water temperatures downstream from Dexter Dam are known to delay spawning, increase adult pre-spawn mortality and cause premature fry emergence in spring Chinook salmon downstream from Dexter Dam. Operating Lookout Point's ROs early in the fall drawdown would use the coolest water available to reduce water temperatures downstream from Dexter Dam. The IMIP offers no measures to reduce the unnaturally warm water temperatures downstream from Dexter Dam.

76. By prioritizing the ROs over powerhouse flows once the reservoir level reaches 825 feet during the annual drawdown, the Plaintiffs' proposal would provide attraction to the

ROs early in the drawdown period, which attracts juveniles toward the dam, thereby giving them a safer route of passage than through the powerhouse when they arrive at the dam.

77. By prioritizing refill during the spring and providing free, ungated spill for two to four weeks each spring (depending on water availability), the Plaintiffs' proposal would provide a safe route of passage during the spring when a large fraction of the annual juvenile migration is known to enter the reservoir. High rates of spring passage have been observed when high inflows necessitated spilling water at Lookout Point (2012). During years when no spill occurs, passage is delayed and the powerhouse is the only route of passage available. Implementing this measure would result in more frequent spring spill, thereby passing fish that enter in the winter/spring quicker, increasing their likelihood of surviving reservoir passage, and provide a safer route of dam passage. The IMIP provides a similar measure but would not initiate spill until the reservoir was 13 feet higher and limits the rate of spill to the flow objective downstream from Dexter Dam. This would delay the date when spill would be provided and reduce the magnitude of spills provided. The Plaintiffs' proposal would provide spill sooner and for a longer period, thereby increasing the opportunities for juveniles to pass safely during the spring.

78. The Plaintiffs propose that the Corps model delayed refill and run-of-river operations and provide the results to the TAT for consideration. Such operations would minimize reservoir residence time for juvenile salmon, provide the easiest access to the safest route of passage, effectively maximizing juvenile passage success while continuing to provide downstream flood control benefits. Also, because water residence time in the reservoir would be very low, the Project's effects on downstream water temperatures would be minimized, thereby benefitting adult spawning and reproductive success downstream.

79. The Plaintiffs propose that following two years of operation under the program described above and the monitoring of its effects, the TAT advise the Corps as to whether to continue the program as described or to modify the program. While the measures described above are based on the best available science and are expected to demonstrate improvement in fish passage survival, they represent an experiment in an adaptive management framework. Evaluating the effectiveness of these measures and recommending improvements is a role the TAT is designed to play.

80. The Plaintiffs propose that the Corps provide to the TAT an analysis of possible operational measures to reduce predatory fish populations in Lookout Point reservoir for review and to implement selected measures within four years. Juvenile survival through the reservoir is low and the stomach samples of northern pikeminnow, walleye, and smallmouth bass from the reservoir include juvenile Chinook salmon. Reducing the populations of predatory fish would directly increase juvenile survival.

81. *Dexter Dam:* This dam operates as a subordinate to Lookout Point operations. Typically, when high levels of discharge from peaking power production at the Lookout Point powerhouse are occurring, water is being stored in Dexter reservoir, leveling discharge at or near the seasonal flow objective downstream. Most discharge at Dexter is through its powerhouse under current operations.

82. The Plaintiffs propose that:

o During the fall drawdown operation at Lookout Point, conduct spill and turn turbines off at Dexter Dam from 4 pm to 8 am. During the spring spill operation at Lookout Point, conduct spill and turn turbines off at Dexter Dam from 7 pm to 7 am. If TDG levels exceed the state standard, the TAT would advise the Corps on when it

is appropriate to use the turbines at Dexter to dissipate TDG based on the extent and duration of the TDG exceedance and the impacts to salmon and steelhead from TDG versus use of turbines.

o Spread spill across gates at Dexter Dam to reduce TDG.

o Conduct a study of pathogen loads by testing for pathogens below Dexter Dam before and after the deep drawdown of Lookout Point and compare to pre-spawn mortality data below Dexter.

o Within two years, improve the Dexter adult fish facility.

83. Spill provides the safest route of passage at Dexter Dam. Spilling to the maximum extent possible at Dexter while operations designed to improve juvenile passage are occurring at Lookout Point Dam maximizes the benefit of this action. Without providing spill for passage at Dexter, fish passage measures at Lookout Point would be less effective. Spreading spill across the gates at Dexter would reduce TDG from the increase in spill, and engaging the TAT in the event that TDG concentrations downstream from the dam exceed state standards would provide real-time information on fish use and the need to adjust actions if too detrimental to the fish.

84. The Plaintiffs propose that the Corps fund studies of pathogen loads in the fish and in the water downstream from Dexter Dam. There is very high pre-spawning mortality for both adults that attempt to spawn downstream of the Dexter fish trap and those that are collected and trucked to release points upstream of the dams. This high rate of pre-spawning mortality limits the opportunity to recover the species. Continued study of this problem may lead to opportunities to reduce it. Also, it has been hypothesized that the prevalence of parasitic copepods in juveniles that pass through Middle Fork reservoirs (Hills Creek, Fall Creek, Lookout Point and Dexter) may be an effect of transporting infected adults to release points upstream of

the dams. Protocols for the examination and treatment of captured adults prior to release upstream should be among the products of this study.

85. *Fall Creek Dam*: Fall Creek Dam is the site of a recent change in operations that drops the reservoir level down to its regulating outlets which are located at the base of the dam, for one week during the fall, typically during November, draining the reservoir and creating a riverine environment with run-of-river flow conditions. This operation is based on an experiment, using a similar operation, that demonstrated high success in passing juvenile salmon. During the initial operation a large quantity of sand, gravel and cobble was liberated in the reservoir as the flow cut through years of accumulated sediment to re-establish its channel. This material initially created high turbidity downstream and large quantities of sand, gravel, and cobble were deposited in Fall Creek downstream from the dam, diminishing in the downstream direction. Further study of these effects demonstrates that the rate of erosion in the reservoir and transport downstream is declining as the hardened natural channel emerges and that the morphology of Fall Creek is adjusting in mostly beneficial ways (improved spawning conditions and greater channel complexity which benefits rearing juveniles) to the amount of sediment released. Hence, the substantial, long-term, beneficial effects to fish passage and survival provided by periodic deep drawdown outweigh the small transient adverse effects like increased downstream turbidity.

86. Based on the highly successful drawdown operation at Fall Creek, the Plaintiffs propose that its duration be extended from December 1 through January 15 each year, rather than for only one week as currently occurs. Although the majority of juveniles passed by the current one-week drawdown pass within 48 hours of the maximum draft, fish continue to pass throughout this period. By maintaining the drawdown for 46 days during the winter, juveniles

that enter the reservoir footprint during this time (mostly sub-yearling Chinook) would pass quickly. Fish that pass during the drawdown would not have to navigate a reservoir, minimizing their exposure to slack-water conditions and the very high rate of copepod infection observed in juveniles sampled in the reservoir, not only their dam passage survival, but their survival subsequent to passage as well.

87. Similarly, maintaining the reservoir at or below 728 feet from April 1 through June 30 would reduce the reservoir footprint, decreasing reservoir travel time for spring outmigrants, increasing their survival.

88. Juveniles sampled in Fall Creek reservoir had the highest intensity of infection of all Project reservoirs studied by Monzyk and others (2013). The average infection included 13 copepods per fish in Fall Creek Reservoir, and nearly one-quarter of all fish sampled had more than 20 parasites on their branchial cavities. The rate of infection (fraction of sampled fish found to be infected) and the intensity of infection (number of copepods per infected individual) have been found to increase with the duration of fish residence in Project reservoirs. Hence, shortening the duration of reservoir residence through the Plaintiffs' measure would further increase juvenile passage survival.

89. *Middle Fork conclusion*: In the aggregate, I expect these measures to result in improved juvenile passage survival throughout the Middle Fork system. By drafting Lookout Point reservoir lower and opening the ROs while turning off the turbines at Lookout Point powerhouse and spilling at Dexter Dam, the Plaintiffs' proposal would greatly improve fall and winter dam passage survival. The deep draft proposed for Lookout Point would shorten reservoir travel time for the fish, providing attraction to and passage through the safest routes available. It is also expected to reduce predatory fish populations. By contrast, the IMIP contains no measure

to assist fall migration. Continued and lengthened deep drawdowns at Fall Creek will allow UWR to express their natural life-history strategy. Improvement to the Dexter fish trap would improve its ability to serve as the source of fish trucked to their native habitats upstream of the dams. By spilling at Lookout Point during the spring, Plaintiffs' measures would offer safe passage during the peak of outmigration, thus allowing for passage during both fall and spring. I conclude that the Plaintiffs' measures are reasonable, implementable, and likely to demonstrate a benefit to UWR Chinook salmon substantially greater than would occur under the IMIP.

Monitoring and Other Measures

90. The Plaintiffs propose a suite of other measures related to monitoring, adaptive management, reporting, and oversight. In my professional opinion, these additional measures are needed to ensure that the Corps remedies its shortcomings related to these issues under the 2008 BiOp and successfully implements the substantive measures discussed above.

91. All of the actions taken during the interim should be viewed as experiments, during which data germane to devising future operations and modification of the Project's physical works would be developed. I strongly support the Plaintiffs' proposed expansion of the Corps' RM&E program to include studies designed to measure fish survival response to the interim measures and changes in viability criteria. These data would also support the ongoing ESA consultation by providing additional information on the efficacy of operational measures and the operation of any proposed structural modifications to the Project to pass fish downstream. This information should have been produced in previous years, but the Corps failed to fulfill the RPA's requirement for interim passage and water quality measures.

92. The TAT is needed to ensure that the measures herein are thoroughly evaluated and to incorporate real-time fish use and needs into the decision framework. A court-sanctioned

TAT would ensure adaptive management decisions incorporate science and are intended to provide meaningful benefit to fish. Given the Corps' past failures to timely implement protective measures, including measures recommended by agency advisory groups (e.g. WATER and OMET) but subsequently rejected by the Corps, I believe the development of a TAT and continued oversight by the Court are important aspects of the Plaintiffs' proposal. The current WATER process is dominated by the Corps which tends to balance system operations in a manner that often prioritizes other uses above ESA-listed fish.

93. The Plaintiffs' proposal to require the Corps to strictly follow maintenance outage schedules and emergency protocols, developed in consultation with WATER and the TAT, will address longstanding problems with these issues. As discussed above, maintenance or other outage events can cause high TDG or flow problems, which can be particularly harmful to fish at certain times of the year. The Corps has not always abided by these schedules and protocols in the past, so it is important that the Corps be obligated to do so moving forward. Further, the Plaintiffs propose that the Corps notify the TAT prior to any declared system emergency and as soon as possible following unforeseen events. This would facilitate a coordinated response to such emergencies such as fish rescue or hatchery operation responses and assessment of the effects of the event.

94. The Plaintiffs request that the Corps seek a rule change to allow TDG concentrations up to 120% of saturation in the waters downstream from Project dams when conducting spill operations to pass fish described above. It is possible that those operations, which are designed to improve fish passage through Project dams and reservoirs, would produce TDG in excess of the state standard. Obtaining waivers or rule changes to allow operations to produce up to 120% TDG would facilitate fish passage operations without regulatory conflict.

Moving to a 120% standard carries some risks for fish. Incubating eggs and pre-emergent fry could suffer injury, or death from prolonged exposure to 120% TDG, as could fish held in traps. However, continued coordination with the TAT would provide real-time information on fish use and when spawning and incubation are occurring, reducing TDG would be given priority and spills reduced as needed. In the event operations designed to safely pass fish cause high TDG in sensitive areas and times, the TAT would be best able to devise alternatives.

95. The Plaintiffs recommend that the Corps reconstitute its Operational Measures Evaluation Team ("OMET") to consider additional measures using information gained since the 2012 OMET Report. Most of the measures studied in 2012 were rejected by the Corps, often for trivial reasons. By developing and evaluating all potential measures designed to benefit fish passage, downstream fish habitat, water temperatures, and TDG, and incorporating information acquired since the 2012 report, the OMET could identify a broader range of protective measures and through use of the most recent data available, gain a greater likelihood of their success. Fish passage through WVP dams and reservoirs is a difficult problem unlikely to be solved with a one-time, slam-dunk solution. Rather, solutions are iterative, test, and observation-based. The OMET process should be continuous.

96. The Plaintiffs propose that the Corps biannually provide the Court with status reports with supporting documentation on progress and compliance with remedy measures. Given the Corps' past tardiness and reluctance to implement meaningful protective measures, continued Court oversight is needed to ensure continued diligence. Oversight by NMFS has proven inadequate. This slow progress toward the implementation of protective measures has added to the continued decline in species viability.

97. The Plaintiffs also propose that the Corps post all completed studies on a publicly-accessible website. This is necessary to provide state agencies and interested non-governmental parties (e.g. the Plaintiffs) ready access to information developed using Corps funding.

Conclusion

98. I strongly support adoption of the Plaintiffs' proposed measures. The IMIP demonstrates that the Corps will continue to take only small steps toward improving fish survival when the declining status of the species requires substantial improvement and large measures. The Plaintiffs' measures are likely to be effective and are easily implementable. They would increase the opportunities for fish to pass the Project safely and lead to improved water quality and fish survival downstream from the dams. In particular: efforts to re-establish populations of UWR Chinook salmon and steelhead upstream of Green Peter Dam; deep drawdowns at Cougar, Fall Creek and Lookout Point Dams; and spills and RO operations to pass fish and control downstream water temperatures are features of the Plaintiffs' proposal that would boost survival but are not provided in current operations or the IMIP. Information gleaned through RM&E following implementation of these measures would further the Corps' adaptive management program, advised by the TAT and the agencies' WATER and OMET processes. Maintaining Court oversight would ensure these measures are timely implemented and only changed or discontinued with reason. Implementing the Plaintiffs' proposed measures would also increase our understanding of how much modifying Project operations could improve fish survival and identify where such measures are inadequate and expensive, large-scale structures are needed.

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

Signed this 16th day of October, 2020 in Oak Grove, Oregon.

Richard A. Domingue

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