**The Dalles Dam North Fishway  
Hydroelectric Project  
Flow and Fish Passage Improvement Plan  
Phase 1: AWSS Attraction Flow Study Plan**

***Preliminary Review Draft***

***October 24, 2014***

**Background**

Two fish ladders currently provide fish passage over The Dalles Dam, one on the Washington side (the north fishway) and one on the Oregon side (the east fishway). Attraction flows for the north fishway were historically in the range of 1,200 cfs.[[1]](#footnote-1) Currently, the Corps of Engineers (Corps) operates the north fishway attraction flows at about 800 cfs. Attraction flows for the east fishway are approximately 4,500 cfs and are provided via two hydroelectric turbines, commonly referred to as the fish water turbines.

Under existing conditions, the north fishway passes an annual average of about 20 percent of the adult salmon and steelhead migrating past The Dalles Dam (Northern Wasco 2014, Jonas and Stansell 1995), but this number drops to approximately 6 percent during periods of no spill (September 1 through October 31) and increases as high as 80 percent during certain spill conditions. The water passing through the turbines on the east side of the dam provides a strong source of attraction and most of the adult salmonids use the east fishway. While a previous study at The Dalles and John Day dams (Jonas and Stansell 1995) determined that increased spill (1,500 cfs and 4,500 cfs from bay 1) did not result in a significant increase in the total counts, proportion, or total passage of salmonids in the north fishway, Keefer et al. (2007) found that Chinook salmon increasingly approached the north fishway entrance as spill increased. In fact, steelhead approached the north fishway two to four times more frequently during periods of spill, and preferred the east entrance or south spillway entrance during periods of no spill (Keefer et al. 2007).

Subsequent monitoring by the Corps in 2011 and 2012 (Cordie et al. 2013) also documented that spill operations appeared to affect passage in the north fishway ladder. Spill volumes ranging from approximately 110,000 to 220,000 cfs, in combination with the spillway divider (wing wall) added in 2004 may impede north ladder passage for adult Chinook. Conversely, recent data also indicates that with no spill, salmonids are not attracted to the north entrance area; hence, an observed decrease in north fish ladder passage immediately after spill cessation (Cordie et al. 2013).

More recently, as salmon stocks have moved toward recovery, National Marine Fisheries Service (NMFS) biologists have become concerned about overcrowding in the East Fishway during periods of peak upstream migration (due to capacity issues and biomass-related changes in hydraulics). In response to this concern, a limited 3-day spill test was conducted in 2013 at The Dalles Dam in an attempt to encourage higher use of the north fishway. While this effort was deemed ineffective in relieving crowding at the east ladder, the study did suggest a limited amount of spill could encourage additional use of the north ladder. Nevertheless, this test was too short and too limited in scope to provide any conclusive information.

In a March 24, 2014 memorandum (NOAA Fisheries 2014a), NOAA evaluated the daily north ladder passage percentages for April through October for the past four years (years since the wing wall was completed). These data indicated that Chinook will pass the north side of the dam in significant percentages when enough spill is provided. At spill levels as low as 30,000 to 40,000 cfs, the distribution of adult Chinook passing the north ladder was in the 20 to 50 percent range.

Based on these findings, NOAA, the Corps, and other members of the FPOM developed and implemented a pilot split flow test (spill test) at The Dalles Dam during the summer and fall of 2014 (NOAA Fisheries 2014b). The FPOM agreed that spill releases over a 12-hour period for 7 days would be acceptable, but that if long-term operational changes are contemplated, a more rigorous test (24-hour duration) would be needed to assess potentially confounding factors. The spill pattern used in the test was developed at the Corps’ Research and Development Center and consisted of 6,000 cfs from bay 1 and 4,500 cfs from bays 7 and 8. This pattern was slightly adjusted after the fourth day of testing to 4,500 cfs from bays 1 and 7 and 6,000 cfs from bay 8. A total spill level of approximately 15,000 cfs was provided for each 12 hour test day.

The results of this test, as described in NOAA Fisheries (2014b), showed that the proportion of fish using the north ladder (verses the east ladder) did respond to the 15,000 cfs spill level with an initial shift of total project passage that averaged about 13 percent and ranged from 12 percent to 17 percent depending on species. Overall, the spill test did shift fish passage to the north ladder and reduced crowding in the east ladder at a time when the project was passing a record high number of adult salmon. The TDG level did not appear to change appreciably with the shift in the spill pattern and did not exceed 110 percent.

This study is designed to complement the work currently being conducted by the FPOM to aid in their evaluation of measures designed to redistribute fish from the east fishway to the north fishway during periods of very high fishway use. It also represents the first step in Northern Wasco PUD’s Flow and Fish Passage Improvement Plan (FFPI Plan) (Northern Wasco 2014). The objective of the FFPI Plan, which is contingent upon successful commercial operation of the proposed North Fishway Project expansion, is to further identify and address any limitations in the lower north fishway entrance and AWSS. Specific elements of the FFPI include:

* Modifying the AWSS conduit gates to provide more flow in the diffuser below weir 74 and specifically weir 70 to increase lower ladder transportation velocities to 1.5 fps or greater;
* Evaluating the feasibility of removing the bulkhead from the second north fishway entrance gate and replacing it with an adjustable weir at the N-2 gate to bring the N-2 entrance into compliance with NOAA’s adult fishway entrance criteria currently met with the operation of the N-1 gate;
* Removing weirs 70 through 73 to eliminate low head drops due to backwater effect;
* Using an appropriate analysis tool (e.g., computational fluid dynamics modeling) to examine the effects of a range of spill flows and the addition of 800 cfs of attraction flow (for a total of 1,600 cfs) on near field attraction during spill conditions and far field attraction during non-spill conditions; and
* Evaluating the potential to improve lamprey passage conditions at the north fishway consistent with Corps recommendations and Tribal guidance. Measures could include replacing the existing 1-inch gap diffuser gratings with ¾-inch gap diffuser gratings, modifying the lower weir pools and entrance weir guides, and replacing the existing fish counting station diffuser grating.

**Study Objective**

The primary objective of this study is to evaluate any changes in fish ladder use at The Dalles Dam north fishway in relation to an increase in flow through the AWSS from 800 to 1,600 cfs during the non-spill period. Monitoring will determine whether the increase in attraction flow has a positive, neutral, or negative effect on the proportion of salmonids using the north fishway verses the east fishway.

**Methods**

Northern Wasco PUD, in consultation with NMFS, the Corps and other FPOM members, will conduct a series of attraction flow tests at the North Fishway Project from April 1 through October 31, 2015. Beginning April 1, approximately 1,600 cfs will be released from the north fishway AWSS for a total of 168 hours (7 days); the flow will then be reduced to approximately 800 cfs for an additional 168 hours. This weekly 800 to 1,600 cfs on-off pattern will continue through the end of October. During these test blocks, generation, spill, lock operations, and flow conditions at the east fishway and ice and trash sluiceway will ideally remain consistent with current operations. However, we recognize that this is not always the case and adjustments may need to be made during the course of the study. The study methods may also need to be slightly modified to accommodate or complement any future upstream passage related spill tests at The Dalles Dam.

During each test block, the adult anadromous fish count (Chinook, coho, steelhead, and sockeye) for upstream passage routes at The Dalles Dam (north and east fishways) will be obtained from the Corps’ adult fish count webpage[[2]](#footnote-2) and used to compare the proportion of fish using each facility at the two AWSS releases. To accomplish this, the mean fish counts on days of 1,600 cfs will be compared to days of 800 cfs and a paired t-test (α = 0.05) will be used to determine whether the difference between them is statistically significant. Analyses will focus on Chinook, coho, steelhead, and sockeye; however, other species (including lamprey) may also be evaluated. Additionally, the 2015 tests will re-run the passage data, subtracting out the first six hours of counts from each test to eliminate any “edge effect” that may have occurred. The tests may also eliminate data collected during periods of unplanned or planned anomalous operational conditions or during any proposed FPOM split flow tests.

Under normal operating conditions, the existing turbine on the north fishway AWSS will produce approximately 800 cfs of attraction flows. To augment the flow to 1,600 cfs, Northern Wasco proposes the following procedures:

* Replace the fixed bulkhead in the N-2 entrance gate position with an adjustable weir that will be held at a fixed depth below tailwater elevation as determined in consultation with the project fisheries biologist. The N-1 gate will be used to regulate the differential across both weir gates. A crane will be needed once per week during the study period to make these adjustments for each test block.
* Open the bypass sluice gates on the intake structure AWSS and control the flow to approximately 800 cfs through the plunge pools to the diffusion chamber.
* If necessary, adjust the diffusion chamber sluice gates to balance the flow through the diffuser basin at the bottom of the fish ladder.
* Assess the existing condition of the N-1 gate, rock channel, and plunge pools prior to the test to ensure their structural integrity and monitor these structures on a daily basis through the duration of the test.

At the conclusion of this study, the fixed bulkhead would be reinstalled and sluice gates returned to their normal operating positions.

If these t-tests indicate a significant increase in the number of fall Chinook using the north fishway at the 1,600 cfs AWSS release (compared to 800 cfs), additional analyses would be conducted to determine the relative change in the proportion using the north fishway compared to the east fishway. If that proportion is found to increase by more than XX[[3]](#footnote-3) percent, it is evident that increasing the attraction flow at the north fishway would benefit upstream fish passage at The Dalles Dam, particularly during periods of peak fall Chinook abundance. This finding of benefit would then trigger continued movement toward obtaining an amended license for the proposed expanded Project. If increasing the flow is found to have relatively small effect on the proportion of fish using the north fishway, Northern Wasco PUD would consult with NMFS, the Corps, BPA, USFWS, tribes, and other regulatory agencies, to determine what actions are to be taken in light of these data.

**Next Steps**

A draft of this study plan will be sent to key members of the Corps’ Study Plan Review Group and FPOM for their review and comment in the fall of 2014, and the plan will be modified as needed to best evaluate the effects of increased attraction flows on anadromous fish during the non-spill period. Pending the results of this evaluation in 2015, the attraction flow test may be repeated in the spring of 2016 to evaluate the effects of increased attraction flows at the north fishway during the 40/40 spill period. Methods would be similar to those described above; however, the study would focus on spring and summer Chinook, steelhead, and sockeye salmon.

**References**

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Jonas, M.R., and R.J. Stansell. 1995. The Dalles and John Day Dams North Ladder Entrance Spill Attraction Flow Evaluation, Summer and Fall, 1993, Spring and Fall, 1994. Fish Field Unit. CENPP-OP-SRF. January 30, 1995.

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NOAA Fisheries. 2014a. File Memorandum from Gary Fredricks, NOAA Fisheries. Subject: The Dalles Dam Split Flow Change Request Form. April 17, 2014. Draft FPP Change Request Form. 14TDA009 Split Flows.

NOAA Fisheries. 2014b. File Memorandum from Gary Fredricks, NOAA Fisheries. Subject: A Review of The Dalles Dam 2014 Spill Test. September 24, 2014.

Northern Wasco (Northern Wasco County People’s Utility District). 2014. The Dalles Dam North Fishway Hydroelectric Project. FERC Project No. 7076. Draft Application to Amend Existing License (Exhibit E).

1. <http://www.nwp.usace.army.mil/Portals/24/docs/locations/thedalles/FS_The_Dalles_2013.pdf> [↑](#footnote-ref-1)
2. http://www.nwp.usace.army.mil/Missions/Environment/Fish/Data.aspx [↑](#footnote-ref-2)
3. To be developed in consultation with the NMFS, USFWS, Corps, BPA, and Tribes. [↑](#footnote-ref-3)