FISH PASSAGE CENTER

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MEMORANDUM

TO: Ed Bowles, ODFW

FROM: Michele DeHart

DATE: March 25, 2014

RE: Recent data and analyses indicate that current fish passage operations can be improved and established processes do not facilitate incorporation of recent data and analyses into management decisions

In response to your request the Fish Passage Center staff has developed the following summary of fish passage operations that are presently implemented which could be modified to benefit and improve fish passage. These modifications have been repeatedly recommended to the action agencies by the fishery managers through the process of developing the Fish Passage Operations Plan (FOP), and through the in-season technical management team process. Each of the current operations is based upon data and analyses that were completed subsequent to the 2008 Biological Opinion (BiOp). The continuous implementation of each of these specific operations, without consideration of recent data and analyses, precludes full implementation of court ordered spill for fish passage and effectively creates a "death from a thousand cuts" scenario, in which small individual operations can cumulatively result in adverse fish passage conditions. Apparent in this review of operations is an unrelenting effort by action agencies to reduce spill for fish passage. The refusal to consider new technical data and analyses establishes a quandary for fish passage. Although significant technical issues have been raised regarding the at-dam performance standard approach and performance standard testing, the action agencies rationalize reductions in spill for fish passage and rejection of recommendations to improve fish passage, on the basis that the performance standards are being met. The overall conclusions of our review are listed below followed by specific discussion of individual operations that could be modified to benefit fish passage.

- The "adaptive management" language of the Biological Opinions could support operations improvements based upon recent data and analyses of fish passage.
- The existing organizational management processes have not resulted in modifications of implementation of recommendations that are based upon recent data and analyses.
- Although significant technical concerns have been raised regarding operations and actions, the concerns have not been addressed and operations have not been modified.
- Planned spill programs are proving to be one of the most important tools in the arsenal used in the recovery of endangered species. Spill improves the downstream passage survival of juvenile salmonid stocks by providing a passage route associated with reduced project delay, and with less mortality relative to powerhouse bypass or turbine passage. These benefits translate into improved survival to adulthood (Schaller and Petrosky 2007; Petrosky and Schaller 2010; Haeseker et al. 2012). The court-ordered spill program has been steadily reduced since its implementation in 2006.

Open Geometry at Bonneville Powerhouse 1

In 2012, high mortality and descaling rates of subyearling Chinook and Sockeye smolts in the Juvenile Bypass System at Bonneville Dam (BON) raised concerns about Fish Passage Plan (FPP) operations at Powerhouse 2. To limit impacts on juvenile fish, the fisheries managers submitted System Operational Requests (SOR 2012-1 and SOR 2012-2) requesting that flows through Powerhouse 2 be limited to the mid-point of the 1% range. This recommended operation would decrease the hydraulic capacity of Powerhouse 2 and the fisheries managers recommended that the excess flows be spilled to the dissolved gas cap. These SORs were "partially implemented," with Powerhouse 2 operated to the mid-point of the 1% operating range, but with excess flows passing through Powerhouse 1 at open geometry. On March 29, 2013, the Fish Passage Operations and Maintenance Coordination Team (FPOM) Bonneville Dam operations task group submitted a Fish Passage Plan change form (14BON001) to the FPOM to address this concern, but this change form is still pending.

Despite the Action Agencies' assertions that the "open geometry" configuration reduces turbulence and therefore provides beneficial fish passage, there are few data for these assumptions (see FPC Memos July 30, 2012; December 17, 2012; December 18, 2012; and May 7, 2013). A balloon tag study (Skalski 2000) tagged only large yearling Chinook and does not represent the effects on smaller migrants. Additionally, this study was not designed to evaluate open geometry compared to other operations, uses methodology that does not mimic actual run-at-large migration, and utilizes large tags known to affect both behavior and orientation through the turbine.

In 2013, a retro-analysis using JSATS tags (originally deployed for performance testing) was presented at the U.S. Army Corps of Engineers (COE) Anadromous Fish Evaluation Program annual review meeting. However, although requested, the details of the data and the analyses have not been made available for review. To date, there is no scientific evidence that increasing turbine passage for smolts is a more beneficial operation than increasing spill.

The data indicate that an operation that limits Powerhouse 2 capacity to the mid-range of the 1% and spills excess to the gas cap is implementable, will increase juvenile survival, limit powerhouse passage, and reduce delayed morality.

Test Operations at Ice Harbor Dam When No Tests Are Occurring

In 2006, operations at Ice Harbor Dam were implemented as alternating blocks of spill recommended by the 2004 BiOp (45 Kcfs day, gas cap night) and 30% spill to conduct a radio tag study of passage survival. Due to high flows, the study could not be completed in 2006 and was extended to the 2007 spill season (Ogden et al. 2008). Survival studies were also conducted in 2009 with radio tags (Axel et al. 2010).

Since 2009, this operation has been continued as part of the rolled over operations under the Court Order, despite the lack of further experimentation. There is no biological reason for these alternating operations. Although experiments in 2007 and 2009 were unable to detect a significant difference in concrete survival (due to extremely low statistical power), there was a significantly higher forebay delay and more smolts passed through the turbines at 30% spill than 45 kcfs/gas cap.

Despite the evidence that spill required by the BiOp is more preferable for outmigration conditions than 24 hours of 30% spill, the COE has used the rollover to extend alternating operations for 5 years past the conclusion of experimentation. This operation results in less overall spill and likely contributes to delayed migration and increased turbine passage. With no justification, the 2014 BiOp calls for the continuation of the alternating operations at Ice Harbor Dam. This is a distinct step backwards in providing spill to protect outmigrating fish. An operation of 45 kcfs/gas cap would increase juvenile survival and decrease powerhouse passage.

Bulk Spill at Lower Monumental Dam

As outlined in the 2008 BiOp, spring spill at Lower Monumental Dam (LMN) has been to the gas cap using the bulk spill pattern. However, the bulk spill creates more dissolved gas, and using the bulk rather than uniform spill pattern has severely curtailed potential spill under the BiOp as flows increase. Over the past several years, salmon managers have logged repeated objections to the continued use of the bulk spill pattern at flows above 60 Kcfs during the spring (SOR 2011-2, Change Form 12LMN007, Joint Technical Staff Memo June 26, 2012, FPC Memo April 25 2011), but no changes have been made by action agencies.

In past years, the Fish Operations Plans have included a statement as justification for the bulk spill pattern, that "Based on a previous year's study results, dam survival is higher under the 'bulk' spill pattern compared to a 'uniform' pattern." The above referenced Joint Technical Staff Memo pointed out that this statement is statistically inaccurate and misleading. In fact, the authors of the 2009 study at LMN (Hockersmith et al. 2010) clearly state that the results of comparing bulk and uniform patterns indicate no significant difference in concrete survival. The higher point estimate was not statistically significant, and only appeared higher due to turbine survival estimates larger than 100%, clearly an overestimate. Additionally, concrete survivals do

not encompass the fact that the uniform spill pattern passed more fish over surface routes with less delay (Hockersmith et al. 2010) while also leading to lower TDG levels.

A change to the uniform spill pattern would allow more spill while remaining safely under TDG limits. This spill could help decrease delayed mortality due to turbine and juvenile bypass systems while decreasing travel time through the hydrosystem. Despite this, the bulk spill pattern is specifically mentioned in the 2014 BiOp. The uniform spill pattern should be implemented to increase protection for migration.

Transportation Dates

In 2006 and later years, the start date of transportation was delayed to allow early migrating fish to remain and migrate in-river. This was based on the NOAA transportation research that showed that these early migrants did not perform well in transport (Hydro Proposed Action Summary). As more fish were allowed to migrate in-river the SARs for these groups improved. However, the 2014 BiOp will move the start of transportation at Lower Granite (LGR) from the recently implemented May 1st date to as early as April 21st. At Little Goose Dam (LGS) and LMN, transportation will be staggered 4 and 7 days, respectively, after the start at LGR. This earlier transportation date, a shift in policy in place since 2007, is being implemented in order to meet a goal of creating two equally sized groups of in-river and transported smolts, supposedly based on the ISAB recommendation (2010). However, the spread-the-risk strategy recommended by the ISAB in 2010 does not advocate for a 50/50 split. Rather, it recommends using both migration methods with no actual ratio defined (ISAB 2010). There is no biological basis for assuming a 50/50 split, and the earlier transportation date is not supported by the most recent survival analyses.

Survival analyses conducted by NOAA use smolts tagged both above and at LGR. However, smolts tagged at LGR are subject to a known survival bias. When the Fish Passage Center removed these smolts from the analyses, they found that for all transported groups (hatchery Chinook, hatchery steelhead, wild Chinook, and wild steelhead) there are no data indicating a benefit to transportation prior to May 1st. For a thorough explanation of this analysis, please see the FPC Memo from February 18, 2014.

A second justification provided for the earlier fixed transportation start date is the maximization of transport/in-river ratios (TIRs). As an example, the BiOp points out that 2006 is the only year among recent years where the TIRs for steelhead and Chinook were below 1.0, which indicates no benefit of transportation (in 2006, transportation began on April 21st). The 2014 BiOp goes further to highlight that there is a documented seasonal benefit from transporting Chinook, and there is no benefit prior to May 1st. The data in the BiOp support a May 1st start date of transportation, so there is no basis in Chinook TIRs for a transportation start date of April 21st.

On July 1, 2013, the FPC issued a memo in response to a data request to estimate the impact of moving the start date of transportation to April 21st over the previous 5 years (2008–2012). These analyses found that moving the transportation start date to April 21st resulted in an increase in the proportion of fish transported for all groups of hatchery and wild yearling Chinook and steelhead, with the largest impact on wild yearling Chinook. Historically, wild yearling Chinook have shown the least benefit from transportation, particularly in years when

transportation began in early April (Tuomikoski et al. 2013). Finally, a transportation start date of April 21st resulted in an estimated proportion destined for transport of greater than 50% in 3 of 5 years of hatchery yearling Chinook, 4 of 5 years of wild Chinook, 3 of 5 years for hatchery steelhead, and 4 of 5 years for wild steelhead.

In addition to the lack of benefit for early transportation, a negative consequence is the increased straying rate for returning steelhead. An increase in the proportion of transported fish (as would happen with an earlier start to transportation) results in increased straying rates. Straying Snake River steelhead has been identified as a threat to the much smaller natural populations in the Deschutes and John Day river basins. This threat is not acknowledged in NOAA suggestions of starting transportation on April 21st at LGR rather than May 1st.

Transportation dates should be determined by available data, including SARs and straying rates. Current data does not support a transportation goal of 50% steelhead, so BiOp requirements for transportation dates should be redefined.

Little Goose 30% Spill

The restriction on spill to 30% in 2006 was based on adult passage delay observed at the project in the summer of 2005 (FOP 2006). Given the fishery agencies' comments that this operation was not appropriate to implement across the season (FPC Memo July 26, 2006), as it significantly reduces the court-ordered spill to the gas cap, the Action Agencies negotiated 14 days of nighttime spill to the gas cap. This nighttime spill was instituted in 2007 and 2008, in addition to 30% spill for the rest of the spring period. In 2009, this additional spill to the gas cap was not implemented to accommodate testing of the new surface passage structure (FOP 2009). This nighttime spill was never restored or included in later Fish Passage Plans, even when surface passage testing was complete.

In 2011, a request was made to the COE to add nighttime spill to the gas cap to alleviate negative outmigration conditions created by operating above the Minimum Operating Pool (MOP) (SOR 2011-3). This request was denied, in part, due to a 2009 study which purported to show no benefit to increased spill. However, subsequent FPC analyses indicated that the 2009 study had limited applicability to other migration years (See FPC Memos August 29 2011; December 9, 2011; December 14, 2011) due to inconsistent survival estimates, changes in operations of the weir elevation, changes in spill patterns, and significant differences in flow levels between years.

The refusal to restore nighttime spill to the gas cap at Little Goose has resulted in reduced spill, longer travel times due to operations above MOP, more juvenile salmonids passing through turbines, and does not represent operations based on the best available science. Restoring nighttime spill to gas cap would be an implementable tool to increase juvenile survival.

John Day 30% and 40% Test Operations

In 2008, test operations of alternating 30% and 40% spill blocks were added to the spring and summer plans for John Day Dam (FOP 2008). This test was to compare juvenile survival at each spill level. In 2008, these studies showed lower forebay residence time and lower tailrace egress time for all three groups tested (yearling Chinook, subyearling Chinook, and steelhead) at 40%

when compared to 30% spill. Point estimates of survival for all three groups were higher under the 40%, and significantly higher for steelhead (Weiland et al. 2009, also see FPC Memo from February 16, 2011). This trend was repeated in 2010 performance tests (Weiland et al. 2013a). In 2011 (Weiland et al. 2013b) and 2012 (Skalski et al. 2013), flows prevented any significant comparisons between operations.

Given the indications that higher spill will reduce delayed mortality, and higher survivals at 40% than 30% spill, migrating smolts may benefit from 40% spill, rather than 30% with alternating blocks of 40% spill during test periods. The continuation of test conditions in the absence of testing, as in 2013, has no biological basis. Despite this, the 2014 BiOp calls for the continuation of these alternating operations at John Day Dam.

McNary 50% Spill

In 2006, summer test operations began at McNary Dam with 40% spill and 60% spill alternating in 2-day blocks. Higher juvenile survival and spillway passage was found at 60% spill when compared to 40% (Adams and Evans 2011). Test conditions continued through 2009, after which operations were averaged to a daily 50% spill. However, the 2005 court order requires spill of all flow over 50 Kcfs, rather than a rollover of test conditions when studies are no longer occurring at the dam.

There are no operational reasons why the court-ordered spill should not be implemented. Studies show that a higher spill at McNary Dam results in higher juvenile survivals and reduced turbine passage.

Earlier End to Spring Spill

The 2014 BiOp will end spring spill and start summer spill earlier than the court order. Under the current court order, summer spill begins on June 21st at Snake River projects. In the 2014 BiOp, summer spill timing will be based on the estimated 95% passage date of PIT-tagged wild yearling Chinook, wild steelhead, and hatchery and wild sockeye, which can be as early as June 1st. However, NOAA has not provided the methodology of how they will estimate the 95% date. On May 28, 2013, the Fish Passage Center provided a memo to the Fish Passage Advisory Committee that outlined the concerns with using PIT tags to estimate passage timing of wild stocks, particularly when marking of wild fish is largely dependent on availability and conditions and is extremely variable between years.

At Lower Granite, Lower Monumental, and Bonneville, an earlier transition to summer spill will result in lower spill. The technical and biological basis for providing reduced spill for summer migrating fall Chinook is not explained by NOAA fisheries and should be evaluated. Additionally, the 95% passage criteria for the transition to summer spill has no biological basis and does not account for late spring migrants which will encounter lower spill levels or issues with non-representative tagging.

Current data indicate that continuing to provide spill for spring migrants through June 21st will provide the best protection for juvenile migrants.

Earlier End to Summer Spill

Under the current court order, summer spill at Snake River sites occurs through August 31st. However, the 2014 BiOp indicates that summer spill may be terminated as early as August 1st at Lower Granite, with a staggered end for downstream dams. Data from the SMP indicates that under the 2014 BiOp, spill would be terminated in the Snake before August 31st in most years (see FPC Memo October 7, 2013). Spill could resume if subyearling Chinook counts exceeded 500 for two consecutive days. However, collections are dependent on the amount of spill provided. Since spill is currently continued through August 31st, there are no data on what collections would be if spill was not provided, and no biological basis for the requirement of 500 smolts.

By continuing to provide spill for summer migrants through August, better conditions can be provided to reduce juvenile mortality and reduce powerhouse mortality.

Performance Testing

Included in the 2008 and 2014 BiOps are performance standards of 96% dam project survival for yearling Chinook and steelhead, and 93% project survival for subyearling Chinook. These standards are not backed up by any data, and no explanation has been provided for a lower survival standard for subyearling Chinook.

To date, the majority of performance tests have been conducted in 2011 and 2012, which were very high flow years with extended periods of uncontrolled spill in the spring and summer. For example, the January–July runoff volume in 2011 was the 9th highest in the last 84 years in the Snake (at LGR) and 4th highest in the Lower Columbia River (at TDA) (FPC 2013). The January–July runoff volumes in 2012 ranked 32nd and 10th over the same period and sites.

High flows in 2011 and 2012 resulted in large amounts of uncontrolled spill at projects where performance testing was taking place. This has resulted in survival estimates under operations of high spill and do not reflect the survivals under the conditions proposed in the 2014 BiOp. For the eight yearling Chinook and eight steelhead performance tests, only the 2010 test at The Dalles Dam (TDA) was conducted with planned spill levels and steelhead did not meet the survival standard of 96%. For subyearling Chinook, nine performance tests have been conducted and only three were conducted during conditions when planned spill levels were mostly met (2010 at TDA, 2013 at Little Goose and Lower Monumental Dams). Of these three, Little Goose and Lower Monumental Dams did not meet the survival requirement. These results indicate that performance testing to date has not tested the actual operations proposed in the 2014 BiOp, and when operations are conducted as planned, survival standards may be harder to meet.

A variety of concerns about performance testing and their failure to represent actual survival levels of the run-at-large have been raised to SRWG. These concerns include the high-grading of the sample population, artificial inflation of estimates through the use of multiple control groups, lack of representative water years (as outlined above), effects of handling and tag burden, and the lack of assessment of long-term or delayed mortality. However, these concerns have generally not been addressed. After rejection rates in 2010 exceeded 12.5%, managers

required revisions to selection criteria to make performance tests more representative of the run-at-large. However, 2010 studies were not dismissed due to high rejection rates, and in 2013 rejection rates were higher than 18%.

Performance standards have been used to the exclusion of other potential metrics of hydrosystem survival. If survival higher than the standard is achievable, especially under higher spill, it is not considered as a potential operation if lower spill levels will meet the standard (see discussion of John Day 30%/40% operations above). Forebay residence time, tailrace egress, delayed mortality, and SARs are not considered and held to standards in the BiOp, which hinders the ability to use the best available science for stabilizing and recovering Salmonid populations.

For detailed descriptions of these issues, please see FPC Memos from June 24, 2009; July 29, 2010; February 16, 2011; March 24, 2011; June 21, 2011; February 15, 2012; March 16, 2012; March 23, 2012; January 4, 2013; February 11, 2013; March 19, 2013; March 22, 2013; October 7, 2013; December 3, 2013; and January 14, 2014.

Inconsistent Use of Rollovers

The history of the Fish Passage Plan shows a consistent use of rolling over experimental operations when tests are no longer being conducted, even when the data indicate they are not optimal for fish. Because a rollover can be included in the Fish Passage Plan without the same review as a change, the use of rollovers is a hindrance to effective adaptive management by fisheries managers.

Some examples of rolling over test conditions include:

- Test conditions at Ice Harbor Dam for experiments from 2006–2009, and then rolled over in following FOPs.
- The cancellation of night-time spill to the gas cap at Little Goose Dam for testing in 2009, rolled over in all subsequent FOPs.
- Alternating 30%–40% spill operations at John Day Dam, even when experiments have not had the statistical power to distinguish between operations.

In contrast, when experimental conditions result in increased spill, such as the 2009 study at Lower Monumental Dam on bulk vs. uniform spill, experimental conditions are not rolled over.

Records and Results of Experiments Not Available

It is difficult to trace the history of many operations on the Columbia and Snake Rivers and the decision-making process that led to those decisions. This lack of transparency for research and monitoring studies makes it difficult to evaluate the effectiveness of operations. The results from studies are used in the decision-making process, but are not readily available for review by fisheries managers. Past studies are not thoroughly reviewed when evaluating proposals for future work, so there is the potential for repeated research and repeated mistakes.

If reports were easily available, such as on an open-access website, operations could be evaluated much more efficiently and easily than currently.

Conclusions

The history of operations since the 2005 court order (requiring all projects to spill to the gas cap) show a steady decrease in protection for fish. Although many changes have occurred in small increments, the cumulative effect is significantly reduced spill, which may lead to higher turbine and juvenile bypass passage, increased direct mortality, and increased latent mortality. The best available data is often not used in the decision-making process, to the detriment of improving fish passage.

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