FINAL

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ANCHOR QEA

Memorandum

To: Wells, Rocky Reach, and Rock Island HCP Hatchery Committees and Priest Rapids Coordinating Committee Hatchery Subcommittee

Date: June 17, 2020

From: Tracy Hillman, HCP Hatchery Committees Chairman and PRCC Hatchery Subcommittee Facilitator

cc: Kristi Geris, Anchor QEA, LLC

Re: Final Minutes of the May 20, 2020 HCP Hatchery Committees and PRCC Hatchery Subcommittee Meetings

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plan Hatchery Committees (HCP-HCs) and Priest Rapids Coordinating Committee Hatchery Subcommittee (PRCC HSC) meetings were held by conference call and web-share on Wednesday, May 20, 2020, from 10:00 a.m. to 11:45 a.m. Attendees are listed in Attachment A to these meeting minutes.

Action Item Summary

Joint HCP-HCs and PRCC HSC

- Mike Tonseth will coordinate with Andrew Murdoch (Washington Department of Fish and Wildlife [WDFW]) to present pre-spawn mortality modeling results for spring Chinook salmon at an upcoming HCP-HC meeting (Item I-A). *(Note: this item is ongoing.)*
- Brett Farman will discuss with Charlene Hurst and Mike Tonseth the potential use of a multi-population model for estimating proportionate natural influence (PNI) for the Nason and Chiwawa spring Chinook salmon programs (Item I-A). *(Note: this item is ongoing.)*
- Greg Mackey will work with Mike Tonseth to test a modeling approach and prepare a white paper on the method for determining a range for the number of females to be collected for a given broodstock in the upcoming year (Item I-A). *(Note this item is ongoing.)*
- Greg Mackey will prepare a plan for alternative mating strategies based on findings described in his previously distributed literature review (Item I-A). *(Note this item is ongoing.)*
- Mike Tonseth will distribute the analysis showing feasibility of the Methow Spring Chinook Outplanting plan based on historic run-size data (Item I-A). *(Note this item is ongoing.)*
- All parties will provide updates on changes to marking and tagging plans due to the impacts of COVID-19 on operations as updates become available (Item I-A). *(Note this item is ongoing.)*
- Kirk Truscott will determine the number of scales that should be collected from spring Chinook salmon at Wells Dam for elemental signature analysis to discern Okanogan River spring Chinook salmon from Methow River spring Chinook salmon (Item I-A). *(Note this item is ongoing.)*

- Tracy Hillman will develop additional estimates of carrying capacity for Wenatchee River Basin spring Chinook salmon spawning aggregates (Item II-A).

PRCC HSC

- None.

Decision Summary

- No decisions were approved during today's meeting.

Agreements

- No agreements were discussed during today's meeting.

Review Items

- The *Monitoring and Evaluation of the Chelan and Grant County PUDs Hatchery Programs Draft 2019 Annual Report* and appendices, which were provided by Tracy Hillman and were distributed to the HCP-HCs and PRCC HSC by Kristi Geris on June 16, 2020, are available for a 30-day review with edits and comments due to Hillman on July 16, 2020.
- The draft Statement of Agreement, *Regarding Chelan PUD's Okanagan Sockeye Obligation and Status of the Reintroduction Program,* was provided to the Rocky Reach and Rock Island HCP-HCs by Kristi Geris on June 13, 2020, and is available for review with edits and comments due to Catherine Willard on July 1, 2020.

Finalized Documents

- There are no documents that have been recently finalized.

I. Welcome

A. Review Agenda, Announcements, Approve Past Meeting Minutes, Review Last Meeting Action Items

Tracy Hillman welcomed the HCP-HCs and PRCC HSC to the meeting and read the list of attendees signed into the meeting. The meeting was held via conference call and web-share because of travel and group meeting restrictions resulting from the COVID-19 pandemic. Hillman reviewed the agenda and asked for any additions or changes to the agenda. Greg Mackey added a brief update on subyearling summer Chinook salmon for orcas. All members approved the agenda with these additions.

The HCP-HCs and PRCC HSC representatives reviewed the revised April 21, 2020 meeting minutes. Minor revisions were resolved in the meeting. The HCP-HCs and PRCC HSC approved the April 21, 2020 meeting minutes, as revised.

Action items from the HCP-HCs and PRCC HSC meeting on April 21, 2020, were reviewed, and follow-up discussions were addressed *(note that italicized text below corresponds to action items from the previous meeting)*:

Joint HCP-HCs and PRCC HSC

- *Mike Tonseth will coordinate with Andrew Murdoch (Washington Department of Fish and Wildlife [WDFW]) to present pre-spawn mortality modeling results for spring Chinook salmon at an upcoming HCP-HCs meeting (Item I-A).*
  Tracy Hillman said this item is ongoing.
- *Brett Farman will discuss with Charlene Hurst and Mike Tonseth the potential use of a multi-population model for estimating proportionate natural influence (PNI) for the Nason and Chiwawa spring Chinook salmon programs (Item I-A).*
  Farman said this item is ongoing.
- *Greg Mackey will work with Mike Tonseth to test a modeling approach and prepare a white paper on the method for determining a range for the number of females to be collected for a given broodstock in the upcoming year (Item I-A).*
  Mackey said this item is ongoing.
- *Greg Mackey will prepare a plan for alternative mating strategies based on findings described in his previously distributed literature review (Item I-A).*
  Mackey said this item is ongoing.
- *Mike Tonseth will distribute the analysis showing feasibility of the Methow Spring Chinook Outplanting plan based on historic run-size data (Item II-A).*
  Tracy Hillman said this item is ongoing.
- *All parties will provide updates on changes to marking and tagging plans due to the impacts of COVID-19 on operations as updates become available (Item II-D).*
  This item will be discussed in today's meeting and will be ongoing.
- *Kirk Truscott will determine the number of scales that should be collected from spring Chinook salmon at Wells Dam for elemental signature analysis to discern Okanogan River spring Chinook salmon from Methow River spring Chinook salmon (Item II-A).*
  Tracy Hillman said this item is ongoing.
- *Keely Murdoch will prepare an updated retrospective analysis of conservation program size to present in the next meeting (Item II-A).*
  This item will be discussed in today's meeting.

PRCC HSC

- *Tracy Hillman will communicate with Denny Rohr, PRCC Chair, regarding the responses from the National Marine Fisheries Service (NMFS) on a potential White River spring Chinook salmon hatchery program and request from the PRCC to provide further direction to the PRCC HSC on this topic (Item IV-C).*
  Hillman said he spoke with Rohr before the PRCC meeting and understands that Rohr shared this information with the PRCC; however, the PRCC had no specific direction to give the PRCC HSC at this time. Hillman recalled that this action item aligned with the discussion about the possibility of updating the Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan; and during the last update, he reported discussing the possibility of updating the plan with the director of the Upper Columbia River Salmon Recovery Board. He recalled that the Recovery Implementation Science Team (RIST) replaced the Interior Columbia Basin Technical Recovery Team, and he said he contacted Ken Currens (Northwest Indian Fisheries Commission) about whether the RIST is still functioning. Hillman said Currens indicated the RIST last convened in 2011 and he has not heard from the group since, but Currens agreed the RIST would be the appropriate group to review the criteria within the recovery plan. Hillman asked Brett Farman if he knows about the status of the RIST, and Farman said he also agrees the RIST seems like the proper group to review the plan, but he is unsure about the status of the group.
- *Brett Farman will inquire within NMFS whether the Upper Columbia River Spring Chinook 5-year status review would evaluate the existing recovery criteria and whether any other salmon or steelhead recovery plans have been updated since their original development (Item IV-C).*
  Farman said yes, the 5-year status review uses the existing recovery criteria. He said he is in the process now of drafting a response to the group to clarify the steps of the process.
  Todd Pearsons asked Farman to clarify what he is asking the group. Farman said he understands the group uses the existing criteria in the review, but he wants to be clear about how the group uses the criteria and incorporates this back into updating the plan. Pearsons asked if the question is whether the group is evaluating the status against the existing criteria. Farman clarified that the group considers the criteria within the recovery plan in the status review to determine whether these criteria still make sense. He said what he needs to follow up on is, if the criteria do not make sense, how does this loop back to updating the recovery plan. Pearsons asked if the group determines that the recovery criteria are no longer suitable, do they include that in their 5-year review? Farman said he understands the group does consider these criteria in their evaluation.

II. Joint HCP-HCs and PRCC HSC

A. Updated Retrospective Analysis of Wenatchee Spring Chinook Salmon Conservation Program Size

Keely Murdoch shared the presentation, *Updated Retrospective Analysis* (Attachment B), which was distributed to the HCP-HCs and PRCC HSC by Kristi Geris following the meeting on May 20, 2020. Murdoch said there is one piece of data from WDFW (recent pre-spawn mortality data) that was not published in the 2018 Hatchery Monitoring and Evaluation (M&E) Annual Report.[1] She said she requested these data from Mike Tonseth (WDFW); however, she only made the request two days ago and the data will not be ready until tomorrow. Murdoch said she does have data through the 2017 return. She said Hughes indicated he can provide 2018 data, but he is unsure whether 2019 data are ready. Murdoch noted that an extra year of data will not significantly change the results. For today, she suggested reviewing what was done last time and how the model works.

Murdoch reviewed slide 2 of Attachment B. She recalled that a retrospective analysis was first performed in 2009 to help develop a plan for the Nason Creek safety-net and conservation program split. She said this slide describes the information inputs in the model. She said estimates of natural-origin recruit (NOR) spring Chinook salmon at Tumwater Dam by spawning location was determined by back-calculating based on spawning ground surveys and assigning a portion of the NORs at Tumwater Dam to each major spawning aggregate. She said this is the dataset WDFW is updating. She said draft escapement goals were developed while drafting the Wenatchee Spring Chinook Management Plan.[2] She said these goals were based on a Beverton-Holt Curve and should be updated, but she does not believe she is the best person to do this. She said the analysis used a sliding scale of PNI, per the Wenatchee Spring Chinook Management Plan and permit. She said the analysis used average Chiwawa River spring Chinook salmon smolt-to-adult return rates (Chiwawa SARs) because there were no Nason Creek data available, and she noted that the updated analysis still uses Chiwawa SARs. She said as the analysis modeled different scenarios, the idea was to develop a solution that balanced maximizing PNI, escapement, and recruits, and minimizing using safety-net fish too often.

Murdoch reviewed slide 3 of Attachment B. She said the retrospective analysis was updated in 2018. She said the SARs were updated from the 2009 analysis to the most recent 10 years, still using Chiwawa data. She said NORs at Tumwater Dam were updated for all years, and she noted that the 2018 update did not just add new years; rather, WDFW researched and reanalyzed all of the data. She said the broodstock needs were updated and new safety-net splits were run for Nason Creek spring Chinook salmon only. She said now that the safety-net program was also using potential

[1] *Monitoring and Evaluation of the Chelan and Grant County PUDs Hatchery Programs, 2018 Annual Report*. September 15, 2019.
[2] *Wenatchee Basin Spring Chinook Management Plan*. November 4, 2010.

Chiwawa NORs in the broodstock, there was an attempt to model a Nason-Chiwawa composite. She said there were a lot of problems with this, which will be discussed later in this presentation.

Murdoch reviewed slide 4 of Attachment B. She said the 2018 update did not use a new pre-spawn mortality level. She said she believes the pre-spawn mortality data currently in this analysis is probably too low, which will also affect the escapement goals. She said if there is a higher pre-spawn curve, this will translate into a higher escapement goal to compensate. She said the 2018 update also did not use a new stock-recruit model. She said all of these things that were lacking in 2018 are still lacking at this point.

Murdoch reviewed slide 5 of Attachment B. She said this is the spreadsheet WDFW produces to estimate wild spawners in major spawning aggregates. She said this spreadsheet includes data up to 2017, but will very soon have 2018, and possibly 2019.

Murdoch reviewed slide 6 of Attachment B. She said she has been trying to think about how to present these data graphically. She said the idea here is to start with the estimated NORs at Nason Creek, which were back calculated from the spawning ground to Tumwater Dam, and there is a target extraction rate. She said this shows how many NORs end up in the broodstock and how many hatchery broodstock are needed to meet those goals. She said this model assumes there are always enough hatchery-origin recruits (HORs) and therefore there is no shortage in HORs. She said the model assumes if there are not enough conservation fish, the program will use safety-net fish. She said the model calculates theoretical escapement goals aimed at hitting a PNI target based on a sliding scale. She said in the end, the model calculates how many HORs are needed from the conservation program to meet both broodstock and escapement needs. She noted the summary in the upper right corner of the slide, which shows the mean HOR run size for the conservation component only. She said this is based on a conversation program of 125,000 fish and considers SARs in an average year to get 608 fish back. She said the SARs can probably be updated with a year or two of data but might not change the outcome a whole lot. She said the data also show, in an average year, the mean HOR needed. She said a mean HOR run size of 608 fish and a mean HOR needed of 429 fish says, in an average year, there are more conservation program fish coming back than what is needed for spawning escapement and broodstock targets. She said this means probably removing conservation program HORs at Tumwater Dam in an average year. She said in a poor return year with a HOR run of 384 fish, hatchery fish would be needed to help meet broodstock targets. She said in a low run size year, there is still a need for safety-net fish on the spawning grounds. She said she is unsure about how often this occurs and that it would be interesting to model. She said for the 125,000-fish program, the mean total escapement is 503 fish, the mean total recruits is 366 fish, and the mean PNI is 0.44. She said this is based on an adult-to-adult curve that Bob Pfeifer (WDFW) put together. She said it would be nice to have an updated curve, but this is not

super relevant to the model. She said if there is more escapement there will be more recruits to the spawning grounds.

Murdoch reviewed slide 7 of Attachment B. She said this slide shows a reduced conservation program size (100,000 fish) and increased safety-net. She said an average year has a mean HOR run size of 486 fish and mean HOR needed of 422 fish. She said this indicates, because these values are so close, in most below average years, there is a shortage of conservation program fish and a need for safety-net fish to meet goals. She said in an above average year, there are excess conservation fish, generally higher escapement, a little more total recruitment, and a little higher mean PNI. She said the tradeoff is, in a below average year, safety-net fish are needed for the program or on the spawning grounds.

Murdoch reviewed slide 8 of Attachment B. She said this slide shows an even more reduced conservation program size (85,000 fish). She said a mean HOR run size of 413 fish equals a mean HOR needed to meet broodstock and escapement goals of 444 fish. She said this means in an average year, help is needed from safety-net fish. She said at some point in an above average year, there will be excess fish. She said with a conservation program and safety-net split, if too many safety-net fish are needed, in her personal opinion, the balance of gene flow is too far in the wrong direction (becoming dominated by hatchery gene flow).

Murdoch reviewed slide 9 of Attachment B. She said this slide shows an attempt to model a combined program. She said the problem is, this only models Chiwawa fish returning to Nason Creek and does not account for returns to the Chiwawa River. She said this is a limitation with this combined model. She said this combined conservation program includes 125,000 fish from Nason Creek and 144,000 fish from the Chiwawa River, with a Nason Creek safety net program of 98,670 fish. She said a mean HOR run size of 1,308 fish equals a mean HOR needed to meet broodstock and escapement goals of 613 fish. She said there is definitely excess conservation fish; however, there is no way to direct Chiwawa River fish to Nason Creek.

Murdoch reviewed slides 10 and 11 of Attachment B. She said these slides each show a slight reduction in the combined program size (compared to slide 9). She said the decrease in HORs needed does not change substantially, partly because this does not model a reduction in the Chiwawa River component of the combined program. She said even a decrease in Nason Creek fish to 85,000 (slide 11) does not result in a significant difference, again, she believes because the Chiwawa River component stays the same (144,000 fish). She said ultimately, it is difficult to interpret these models (for a combined program) because there is no parsing out of HORs returning (to the Chiwawa River versus Nason Creek).

Murdoch reviewed slide 12 of Attachment B. She said in summary, reducing the program can result in more fish on the spawning grounds. She said she would like to see how adjusting the escapement goal will impact decisions on reducing the program size. She said the fourth bullet on slide 12 essentially applies to all scenarios ranging from the middle down to 100,000-fish programs. She said she needs to discuss the last bullet on slide 12 with the Yakama Nation (YN) HCP Policy Committees representative because this person has recently changed. She said the YN has always supported using safety-net fish in broodstock and on spawning grounds because this is what safety-net fish are for when used in a conservation program; however, she is unsure if this will change with more conservation fish. She lastly noted that the biggest changes to these numbers will be the addition of recent pre-spawn mortality and escapement data.

Todd Pearsons recalled discussing during previous meetings using the capacity estimate that Tracy Hillman provides each year in the Hatchery M&E Annual Report, but these estimates are based on adult-to-juvenile survival and not adult-to-adult. Pearsons said his understanding of estimates based on adult-to-adult survival is they (capacity estimates) are not as clear. He said the R squared (R^2) is lower than 0.20. He said there are already good capacity and escapement estimates in the Hatchery M&E Annual Report. Murdoch said yes, the capacity estimate (from the 2018 Hatchery M&E Annual Report) is used in this analysis and the total escapement goals come from the Wenatchee Spring Chinook Management Plan based off of an adult-to-juvenile Beverton-Holt Curve and are not based on adult-to-adult survival. She said, however, these need to be updated but she does not feel equipped to do so. She said she agrees with Pearsons that a new analysis will include stock-recruitment data that will adjust the curves. Murdoch clarified that where adult-to-adult survival is used in this analysis it is useless. She said, to her, the last column in slides 6 to 11 is irrelevant and can be assumed to be not very accurate. She said all these data show are correlations between total escapement and how many adults return, in theory. She said she is okay with focusing on how often the program is reaching the escapement goals.

Pearsons asked on slide 6 of Attachment B, if the Nason Creek escapement goal of 542 fish is the estimate of number of adults versus the number of juveniles in 2009 or has this number been updated since then? Murdoch said this is not an updated number. She said this number was used in the Wenatchee Spring Chinook Management Plan and was modeled at the time the plan was written. Pearsons said he thinks the Beverton-Holt or hockey stick models were used to create these estimates in the Hatchery M&E Annual Report, and the report includes number of years and how these estimates changed over time. He said he thinks this information is readily available. Hillman said this is correct and added that the draft 2019 Hatchery M&E Annual Report will be available by mid-June 2020. He said escapements needed to achieve maximum smolt capacity are available from the Hatchery M&E Annual Report and the report shows how the escapement numbers vary over time

as more stock-recruitment data are added. He said the 2019 report will include updated data for the Chiwawa River, Nason Creek, and the White River.

Murdoch said the new data can be modeled; however, 542 fish is the number everyone agreed to, as included in the Wenatchee Spring Chinook Management Plan. She said the HCP-HCs and PRCC HSC need to review the new data and agree as a group to new escapement goals, if deemed appropriate. Hillman agreed the HCP-HCs and PRCC HSC need to all agree to this. Pearsons asked if this number was generated in a WDFW and YN document. Murdoch said the document started as a WDFW and YN publication, then National Oceanic and Atmospheric Administration's Northwest Fisheries Science Center became involved and attended meetings, and then the rest of the HCP-HCs reviewed and approved the final document. She said the document includes all of these agency's logos. She said she believes the PRCC HSC was also involved but would need to verify.

Hillman said he reviewed the final 2018 Hatchery M&E Annual Report and the escapement estimates, which are based on smolts produced per spawner, are about half the number shown in Attachment B. He said the annual report numbers range in the 200s compared to 542 fish in Attachment B, which makes it seem that the values in Attachment B might be based on adult-to-adult and not adult-to-smolt. Murdoch said she thinks the escapement goals in the Wenatchee Spring Chinook Management Plan include estimates of pre-spawn mortality at Tumwater Dam, and the higher the pre-spawn mortality the more fish that are needed. She suggested reviewing the Beverton-Holt Curve to determine how many fish are needed to achieve escapement goals with estimates of pre-spawn mortality. Hillman said this makes sense and noted that his work does not include pre-spawn mortality; rather, his work only looks at smolts in Nason Creek based on spawners in Nason Creek, which may be why the number in Attachment B is greater.

Murdoch said she thinks including updated information from the Relative Reproductive Study with new pre-spawn mortality will be important. She said this may not necessarily be the same for HORs and NORs and this may also change the composition of the conservation program. She said Attachment B is just a concept and a fairly simplistic model. She said she thinks this topic is more complicated than this, but the model provides an idea of HOR needs, what is coming back, and whether there is a big or little need for safety-net fish. She said it would be interesting to develop a curve graphically showing run sizes and how often to use safety-net fish.

Pearsons said a main reason for this exercise is because NORs are used in the Nason Creek Program and when returning progeny from these fish are not needed, the fish are removed at Tumwater Dam. He said when this is done routinely, it does not seem like the best use of NORs. He said if there is concern, then it needs to be clear what tradeoff will be involved by reducing this risk. He said in some ways, there is reducing risk by killing fish at Tumwater Dam versus the risk of having not the most optimal fish in the broodstock and on the spawning grounds. He said this is a tradeoff issue

and it is not clear how to work through this. He asked, what is an acceptable tradeoff? Murdoch agreed and said she hates to see NORs used for broodstock and then their progeny removed at Tumwater Dam. She said this issue comes down to comfort levels. She said reduced conservation and more safety-net fish results in gene flow running the wrong direction. She said she is personally intrigued by the middle model but needs to discuss this with YN policy staff.

Hillman said he will develop additional estimates of carrying capacity for Wenatchee River Basin spring Chinook salmon spawning aggregates and Murdoch said she will obtain recent pre-spawn mortality data from WDFW to incorporate into an updated Retrospective Analysis of Conservation Program Size.

Hillman shared Table 6.19 from the final 2018 Hatchery M&E Annual Report, as follows:

Table 6.19. Estimated parameters and statistics associated with fitting the Ricker model to spawning escapement and smolt data. Smolts represent numbers of smolts produced entirely within the Nason Creek watershed. *A* = alpha parameter; *B* = beta parameter; SE = standard error (estimated from 5,000 bootstrap samples); and r^2 = coefficient of determination. Spawners represent the stock size needed to achieve population capacity.

Years of data	Parameter				Population capacity	Intrinsic productivity	Spawners	r^2
	A	*A* SE	*B*	*B* SE				
5	90.60	87.13	0.0046	0.0015	7,293	91	219	0.453
6	90.02	5618.57	0.0045	0.0014	7,360	90	222	0.442
7	92.67	1696.44	0.0046	0.0009	7,395	93	217	0.517
8	107.07	1208.15	0.0052	0.0012	7,575	107	192	0.454
9	99.89	1125.42	0.0051	0.0012	7,149	100	195	0.409
10	90.35	50.04	0.0049	0.0008	6,825	90	205	0.470
11	72.26	34.50	0.0043	0.0009	6,240	72	235	0.308
12	76.76	31.24	0.0043	0.0008	6,522	77	231	0.337
13	35.98	32.48	0.0030	0.0013	4,412	36	333	0.049
14	47.48	29.79	0.0035	0.0011	4,962	47	284	0.038
15	49.93	24.34	0.0036	0.0009	5,088	50	277	0.042

Hillman said this table is updated with new data every year. He said the table starts with 5 years of data to estimate population capacity, using the Ricker Model. He said as years of data are added, the capacity and spawner estimates change. He said currently, based on 15 years of data, the model indicates that 277 adults are needed to fully seed the Nason Creek subbasin, which produces 5,088 smolts. He said the relationship looks like Figure 6.6, as follows:

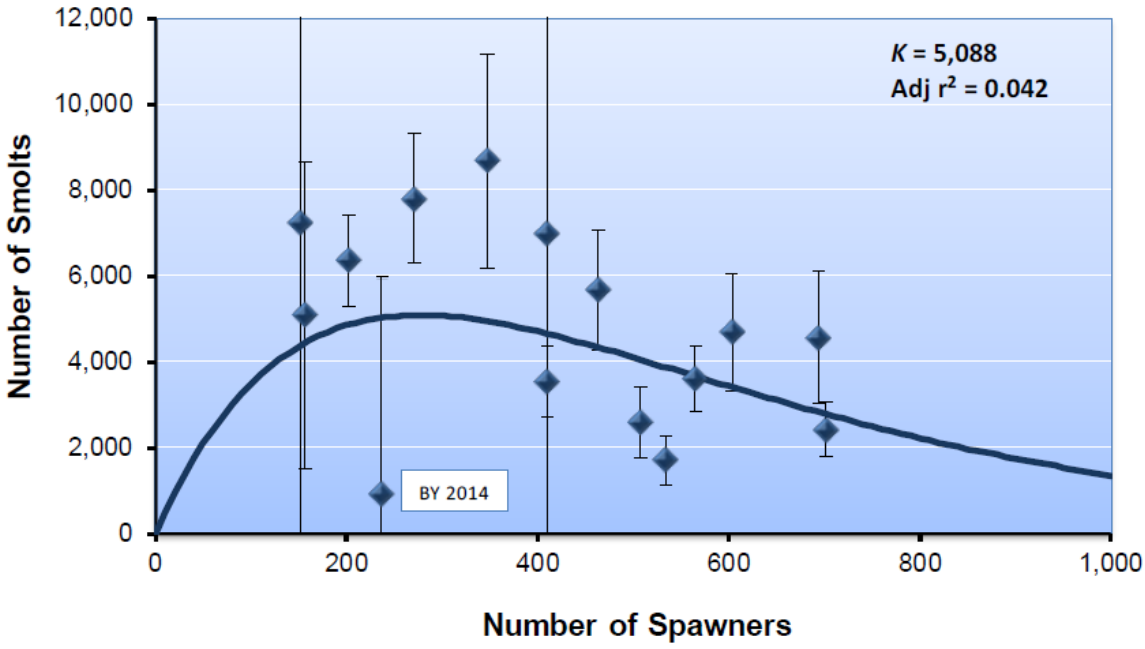

Figure 6.6. Relationship between spawners and number of yearling smolts produced in the Nason Creek watershed. Population carrying capacity (*K*) was estimated using the Ricker model. Vertical bars represent 95% confidence intervals on smolt estimates.

Hillman said an increase in spawners beyond about 300 fish results in a relatively strong density-dependent effect. He said brood year (BY) 2014 has a strong effect on the results. He said this BY produced very few smolts and pulls the curve down. He said if this data point was not here, the capacity would be much higher. Hillman said what Murdoch is suggesting is to include pre-spawn mortality, which would increase maximum spawner estimates.

Greg Mackey said in Figure 6.6, even with the 2014 point removed, the maximum number of spawners would not change much. He said considering the 95th percentile (using quantile regression techniques) would give a higher smolt capacity estimate but the number of spawners to achieve those smolts would not change a lot. Hillman said this is a good point, noting that the Ricker Curve could be fit to the upper 95% distribution of the data but the hump on the curve would still occur between 200 and 300 spawners. He said the Ricker Curve is currently estimating the average population condition, which is not the same as habitat capacity. Fitting the curve to the upper 95% distribution would provide a closer estimate of habitat capacity.

B. Effect of COVID-19 Pandemic on M&E Activities

Tracy Hillman asked each Committee member to provide an update on impacts of the COVID-19 pandemic on M&E activities. Hillman said Kirk Truscott indicated that nothing has changed for the Colville Confederated Tribes since last month. Hillman said Truscott's time is being consumed by writing COVID plans and M&E activities are currently ongoing.

Alf Haukenes said WDFW is in the same position, that the update last month is consistent with where WDFW is now. Hillman noted as described in the monthly report,[3] WDFW was unable to conduct steelhead spawning surveys, and he asked if WDFW crews are now conducting these surveys. Haukenes said some steelhead surveys are being conducted in Washington State; however, the ones referred to in the report are not.

Brett Farman said NMFS has no new updates. He said there are ongoing discussions but nothing new. He said the general guidance is to consider human safety first and address ramifications of data gaps, as necessary.

Bill Gale said U.S. Fish and Wildlife Service (USFWS) restarted the marking and tagging program. He said this started initially as day trips from Vancouver, Washington, to the Gorge, Little White Salmon, and Carson National Fish Hatcheries (NFHs). He said he thinks crews are nearing completion at these locations and USFWS now has authorization for overnight travel for the tagging program. He said crews will move to Winthrop NFH to tag there in a few weeks. He said in terms of field work, almost all work is on hold. He said USFWS is conducting in-hatchery monitoring. He said USFWS is working on obtaining approval for activities that do not require travel and where social distancing requirements can be met. He said he anticipates USFWS will receive approval in the next week or so. He said activities such as electrofishing will be on hold for a while because there is no way to socially distance; however, redd surveys and trap and haul activities may move forward soon.

Keely Murdoch said originally, the general guidance allowed only essential employees for essential activities (i.e., keeping fish alive). She said on a case-by-case basis, the YN is now obtaining authorization to perform other activities as long as the activities can be conducted while socially distancing, and the activities are time-sensitive and inclusive of Endangered Species Act-listed species. She said the YN has restarted the smolt traps and kelt collection at Rock Island Dam. She said fortunately for coho salmon, YN staff were able to complete acclimation and release the fish before restrictions were in place due to COVID-19, and it will be a while before adults return.

Catherine Willard said everything is on par for Chelan PUD and staff are able to do everything with social distancing. Hillman asked if the University of Washington database[4] is uploading Chelan PUD

[3] *Chelan and Grant PUD Hatchery Programs Monitoring and Evaluation Progress Report, April 2020*
[4] Columbia River Data Access in Real Time (DART), available at: http://www.cbr.washington.edu/dart/query/adult_graph_text

data yet and recalled last month that Willard indicated there were issues with dam counts being posted to the site. Willard said the issue is now fixed and data are updated.

Greg Mackey said field work was successfully completed for the Douglas PUD 2020 Survival Verification Study. He said at the hatchery facilities and for trapping activities, personnel are limited to Douglas PUD and Charlie Snow's WDFW Twisp Office crews. He said Douglas PUD is trying to limit different individuals working on site, so there are not a lot of people cycling though.

Todd Pearsons said Grant PUD has pre-release sampling for Priest Rapids Dam scheduled this week. He said a new process regarding M&E contractors is that the contractors need to conform to Grant PUD COVID-19 risk policies. He said Grant PUD anticipates obtaining all data normally collected for pre-release sampling. He said the Nason Creek fish release occurred at the end of April 2020, and fish looked good. Haukenes asked in terms of COVID-19 risk policies for Priest Rapids Dam, is this information on the Grant PUD website? Pearsons said Steve Richards (WDFW) has this information, which was signed by both Grant PUD and WDFW to be compliant with these policies.

III. Rock Island/Rocky Reach HCP-HCs

A. Brood Year 2019 Chiwawa Spring Chinook Salmon Marking Strategy

Catherine Willard said background information for determining the BY2019 Chiwawa spring Chinook salmon marking strategy (Attachment C) was distributed to the HCP-HCs by Kristi Geris on May 19, 2020.

Willard said this year, marking and tagging for the BY2019 Chiwawa Conservation Program will begin in a couple of months. She said like last year, there are a lot of hatchery-by-hatchery (HxH) fish to backfill the conservation program, and again like last year, Chelan PUD needs to determine how to mark and tag these fish. She said as a reminder, the second table in Attachment C shows how many HxH fish were used to backfill the conservation program for BY2018, along with the tagging scheme that was approved by the HCP-HCs last March 2019. She said HxH fish will be adipose (ad)-present, coded-wire-tagged (CWT) in the snout, and blank-wire-tagged (BWT) in the caudal fin. She said Chelan PUD wants to be sure the HCP-HCs are aware that when BWT tagging BY2018 fish, among the Chiwawa Program HxH fish that received CWTs in the snout and BWTs in the caudal fin, 1% of these fish developed deformities in the spine from inserting the caudal BWT. She said Chelan PUD and the WDFW marking crew discussed how to avoid this in the future. She said the same deformities were observed in Nason Creek Conservation Program fish when using caudal tags. She said crews moved to CWTs in the dorsal fin for the Nason Creek wild-by-wild (WxW) fish, and HxH fish, that were ad-present received BWTs in the caudal fin. She said again, Chelan PUD wanted to notify the HCP-HCs this was happening, and that Chelan PUD will need to decide quickly how to

mark HxH fish this year because there are a lot of fish to mark. She said Chelan PUD can continue with the same marking strategy if this is still the preference of the HCP-HCs.

Keely Murdoch said the crooked spine is disappointing; however, the YN is not supportive of ad-clipping these fish because these are still conservation program fish. She said the YN is open to other suggestions. She said the YN has had these same discussions regarding coho salmon. She said she believes WDFW methodologies and techniques might differ from other crews and she suggested that these crews share information about how to perform body tagging better (e.g., modifying the angle). She said she spoke with Cory Kamphaus (YN) about this and he provided information back when this was first discussed regarding Nason Creek fish. Murdoch said she can look for this information again.

Tracy Hillman summarized that Chelan PUD is proposing to move forward with the same tagging scheme for the BY2019 Chiwawa Program HxH backfill fish, and maybe these crews can discuss how to minimize effects.

IV. Wells HCP-HC

A. Subyearling Summer Chinook Salmon for Orcas

Greg Mackey said Douglas PUD and WDFW received the Section 4(d) permit from NMFS for the subyearling summer Chinook salmon program for orcas. He noted that there were issues during marking and about 25% of these fish were ad-clipped too deeply.

V. PRCC HSC

A. Review Agenda, Announcements, Approve Past Meeting Minutes

The PRCC HSC representatives approved the April 21, 2020 meeting minutes as revised.

B. No Net Impact Infographic

Todd Pearsons recalled that last month, he presented an infographic, which Pearsons clarified is a Grant PUD document and not a PRCC HSC document. He said this will be inserted into a financial report that Grant PUD produces, which is part of the reasoning behind the financial numbers included in the infographic. He said he received good comments and a number of these comments were incorporated into a revised version of the infographic. He reviewed the revisions, including updating the hydropower development/operation icon in the upper left corner, per comments received from Bill Gale. Pearsons said he did not have time to obtain permissions for using all agency logos; therefore, the agency names were inserted instead. He said the infographic was changed to highlight the number of hatchery programs. He said the hatchery production number was changed from 10 million to 8.8 million, to include only Grant PUD fish. He said some of the symbols under

habitat preservation that were dollar signs were changed to checkmarks to make the graphic more about the projects instead of money. He said he appreciates everybody's feedback and it helped make improvements to the infographic.

VI. Next Meetings

Tracy Hillman said the draft 2019 Hatchery M&E Annual Report will be distributed for review before the next meeting. He said some sections will be missing because the scale-reading lab at WDFW shut down due to COVID-19 and Wenatchee summer Chinook salmon scales have not been analyzed. He said he hopes to have these sections completed before the final report is due. He said the draft report will be available for a 30- or 60-day review period. He said he and others are also working on the draft 10-year Comprehensive Report.

The next HCP-HCs and PRCC HSC meetings will be Wednesday, June 17, 2020, Wednesday, July 15, 2020, and Wednesday, August 19, 2020, held by conference call and web-share until further notice.

VII. List of Attachments

Attachment A List of Attendees
Attachment B Updated Retrospective Analysis PowerPoint
Attachment C Background Information for Determining the BY2019 Spring Chinook Salmon Marking Strategy

Attachment A
List of Attendees

Name	Organization
Kristi Geris	Anchor QEA, LLC
Tracy Hillman	BioAnalysts, Inc.
Scott Hopkins	Chelan PUD
Catherine Willard*	Chelan PUD
Tom Kahler*	Douglas PUD
Greg Mackey*	Douglas PUD
Peter Graf‡	Grant PUD
Deanne Pavlik-Kunkel	Grant PUD
Todd Pearsons‡	Grant PUD
Brett Farman*‡	National Marine Fisheries Service
Bill Gale*‡	U.S. Fish and Wildlife Service
Alf Haukenes	Washington Department of Fish and Wildlife
Chad Jackson*‡	Washington Department of Fish and Wildlife
Keely Murdoch*‡	Yakama Nation

Notes:
* Denotes HCP-HCs member or alternate
‡ Denotes PRCC HSC member or alternate

Updated Retrospective Analysis

Nason Creek Conservation + Safety Net Program and current management plan

Retrospective Analysis 2009

- A look back at ‘what might have been’ based on the draft management plan
  - Estimates of NOR spring Chinook at Tumwater by spawning location
  - Draft Escapement goal (Beverton Holt Curve)
  - Sliding Scale of PNI (as per Wentachee Spring Chinook Management Plan
  - Chiwawa SARs (10 year: mean, min, max)
  - Conservation and Safety Net program sized to:
    - Maximize PNI
    - Maximize Escapement
    - Maximize Recruits
    - Minimize use of Safety Net fish on the spawning grounds and in the broodstock

2018 Update

- Updated SARS with most recent 10 years (still Chiwawa)
- Updated NORs at Tumwater – all years
- Updated Broodstock needs
- Re-ran analysis with new safety net splits
  - Nason Only
  - Nason Chiwawa Composite

2018 Update

- Did not use a new prespawn mortality level
- Did not use a new escapement goal (as a result of new prespawn mortality information)
- Did not use new stock-recruit models
- To make the update complete new prespawn mortality rates and resulting escapement goals need to be updated!

		Wild Spawners in Individual Major Spawning Areas												
Brood	Wilds	NASON		CHIWAWA		WHITE		LI'L WENATCHEE		WENATCHEE MS		Total wild	% Wild spawners	Nason+ Ch
Year	at TWD	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	spawners	to Tumwater Total	Combined
1999	173	22	12.8%	88	50.6%	3	1.6%	8	4.8%	0	0.0%	121	0.698	110
2000	651	223	34.3%	263	40.3%	27	4.1%	22	3.3%	31	4.8%	566	0.869	486
2001	2073	294	14.2%	497	24.0%	126	6.1%	95	4.6%	49	2.4%	1,061	0.512	791
2002	1033	347	33.6%	281	27.2%	80	7.7%	96	9.3%	66	6.4%	870	0.842	628
2003	919	193	21.0%	205	22.3%	38	4.1%	26	2.8%	21	2.3%	482	0.525	398
2004	898	297	33.1%	573	63.8%	54	6.0%	39	4.3%	46	5.1%	1,009	1.124	870
2005	594	83	13.9%	140	23.5%	119	20.1%	38	6.4%	9	1.5%	388	0.653	222
2006	573	118	20.6%	116	20.2%	41	7.1%	26	4.5%	6	1.1%	307	0.536	234
2007	324	82	25.2%	157	48.4%	62	19.2%	79	24.3%	9	2.7%	388	1.199	239
2008	631	139	22.1%	196	31.1%	20	3.1%	13	2.1%	0	0.0%	368	0.583	335
2009	777	164	21.1%	305	39.3%	81	10.5%	43	5.6%	0	0.0%	594	0.764	469
2010	880	59	6.8%	416	47.3%	26	3.0%	31	3.5%	3	0.3%	535	0.608	476
2011	1225	252	20.5%	795	64.9%	26	2.2%	71	5.8%	8	0.7%	1,152	0.941	1047
2012	1470	222	15.1%	575	39.1%	89	6.1%	44	3.0%	4	0.2%	934	0.635	797
2013	938	72	7.6%	414	44.2%	45	4.8%	79	8.4%	0	0.0%	610	0.650	486
2014	991	199	20.1%	545	55.0%	48	4.9%	68	6.8%	9	0.9%	869	0.877	744
2015	1177	145	12.4%	404	34.3%	105	8.9%	62	5.3%	28	2.4%	745	0.633	549
2016	927	143	15.4%	410	44.2%	74	7.9%	61	6.6%	4	0.4%	691	0.746	553
2017	499	90	18.1%	191	38.3%	20	4.0%	33	6.6%	12	2.5%	347	0.695	282

Current Program back-cast. Theoretical Nason Creek backcast (1999-2008) of broodstock, escapement, and PNI objectives.

NOR Brood Goal (Conservation Programs Only - Safety Net Excluded)		74				Conservation Program:	SAR (BY2002-2011)		SAR (89-11)			
Nason Creek Escapement Goal		542				**Mean HOR run size:**	**608**	0.004864	**581**	0.00465		
NOR Target Extraction Rate		33%				**Minimum HOR runs size:**	**384**	0.003076	**45**	0.00036		
Conservation Program Size				**125,000**	**56%**	**Maximum HOR run size:**	**792**	0.006334	**1953**	0.01562		
Safety Net Program Size				**98,670**	**44%**		**10 year**	**All**				
				223,670		**Mean HO R Needed**	**429**	**376**				
						Minimum HOR Needed	**139**	**116**				
						Maximum HOR Needed	**557**	**594**				
						Mean / Total Escapement	**503**	5033	**469**	**8744**		
						Mean/ Total Recruits	**366**	3795	**365.51**	**6945**		
						Mean PNI*	**0.44**		**0.46**			
						***PNI Calcuated for the whole basin may be higher**						

Year	Estimated Nason NOR Run Size at TWD	Target Extraction Rate	NOB	HOB	pNOB	Theoretical Escapement NOS	Theoretical Escapement HOS	Total HOR Needed	Total Esc'nt	pHOS	PNITarget	PNI	Est. No. Adult NOR Recruits	2.96E-01 / 2.00E-03
1999	22	0.333	7	67	0.10	15	527	594	542	0.97	Any	0.09	393	
2000	223	0.333	74	0	0.99	149	393	466	542	0.72	0.50	0.58	393	
2001	294	0.333	74	0	1.00	220	220	294	440	0.50	0.67	0.67	375	
2002	347	0.333	74	0	1.00	273	257	257	530	0.48	0.67	0.67	391	
2003	193	0.333	64	10	0.86	129	413	423	542	0.76	0.50	0.53	393	
2004	297	0.333	74	0	1.00	223	222	222	445	0.50	0.67	0.67	376	
2005	83	0.333	28	46	0.37	55	70	116	125	0.56	0.40	0.40	229	
2006	118	0.333	39	35	0.53	79	341	376	420	0.81	0.40	0.40	370	
2007	82	0.333	27	47	0.37	55	70	117	125	0.56	0.40	0.40	229	
2008	139	0.333	46	28	0.63	93	449	477	542	0.83	0.40	0.43	393	
2009	164	0.333	55	19	0.74	109	433	452	542	0.80	0.40	0.48	393	
2010	59	0.333	20	54	0.27	39	503	557	542	0.93	Any	0.22	393	
2011	252	0.333	74	0	1.00	178	364	364	542	0.67	0.50	0.60	393	
2012	222	0.333	74	0	1.00	148	394	394	542	0.73	0.50	0.58	393	
2013	72	0.333	24	50	0.32	48	494	544	542	0.91	Any	0.26	393	
2014	199	0.333	66	8	0.90	133	409	417	542	0.76	0.50	0.54	393	
2015	145	0.333	48	26	0.65	97	445	471	542	0.82	0.40	0.44	393	
2016	143	0.333	48	26	0.64	95	447	473	542	0.82	0.40	0.44	393	
2017	90	0.333	30	44	0.41	60	95	139	155	0.61	0.40	0.40	256	
Mean	**165**		**50**	**23**	**0.69**	**116**	**347**	**376**	**469**	**0.72**		**0.46**	**365.51**	Average All (1999
10-Year Mean	**149**		**48**	**26**	**0.65**	**100**	**403**	**429**	**503**	**0.79**		**0.44**	**366**	Average Last 10 ye

Summary of Option 1: This option has the potential to produces the lowest PNI, lowest Escapement, and lowest total Recruits. Hatchery returns are in excess of what is needed in most.

Reduced Conservation Program and increased Safety-Net

Brood Goal	59		
Nason Creek Escapement Goal	542		
Target Extraction Rate	33%		
Conservation Program Size		**100,000**	**45%**
Safety Net Program Size		**123,670**	**55%**
		223,670	

Conservation Program:	SAR (BY2002-2011)		SAR (89-11)	
Mean HOR run size:	**486**	0.004864	**465**	0.00465
Minimum HOR runs size:	**308**	0.003076	**36**	0.00036
Maximum HOR run size:	**633**	0.006334	**1562**	0.01562
	10 year	**All**		
Mean HO R Needed	**422**	**380**		
Minimum HOR Needed	**209**	**166**		
Maximum HOR Needed	**542**	**579**		
Mean / Total Escapement	**512**	5118	**487**	**9118**
Mean/ Total Recruits	**375**	3849	**375.17**	**7128**
Mean PNI*	**0.48**		**0.49**	

***PNI Calcuated for the whole basin may be higher**

Year	**Estimated Nason NOR Run Size at TWD**	**Target Extraction Rate**	**NOB**	**HOB**	**pNOB**	**Theoretical NOS**	**HOS**	**Total**	**Total Esc'nt**	**pHOS**	PNITarget	**PNI**	Est. No. Adult NOR Recruits	**2.96E-01** **2.00E-03**
1999	22	0.333	7	52	0.12	15	527	579	542	0.97	Any	0.11	393	
2000	223	0.333	59	0	1.00	164	378	437	542	0.70	0.50	0.59	393	
2001	294	0.333	59	0	1.00	235	225	284	460	0.49	0.67	0.67	379	
2002	347	0.333	59	0	1.00	288	254	254	542	0.47	0.67	0.68	393	
2003	193	0.333	59	0	1.00	134	408	408	542	0.75	0.50	0.57	393	
2004	297	0.333	59	0	1.00	238	222	222	460	0.48	0.67	0.67	379	
2005	83	0.333	28	31	0.47	55	135	166	190	0.71	0.40	0.40	281	
2006	118	0.333	39	20	0.67	79	463	483	542	0.85	0.40	0.44	393	
2007	82	0.333	27	32	0.46	55	125	157	180	0.70	0.40	0.40	275	
2008	139	0.333	46	13	0.78	93	449	462	542	0.83	0.40	0.49	393	
2009	164	0.333	55	4	0.93	109	433	437	542	0.80	0.40	0.54	393	
2010	59	0.333	20	39	0.33	39	503	542	542	0.93	Any	0.26	393	
2011	252	0.333	59	0	1.00	193	349	349	542	0.64	0.50	0.61	393	
2012	222	0.333	59	0	1.00	163	379	379	542	0.70	0.50	0.59	393	
2013	72	0.333	24	35	0.41	48	494	529	542	0.91	Any	0.31	393	
2014	199	0.333	59	0	1.00	140	402	402	542	0.74	0.50	0.57	393	
2015	145	0.333	48	11	0.82	97	445	456	542	0.82	0.40	0.50	393	
2016	143	0.333	48	11	0.81	95	447	458	542	0.82	0.40	0.49	393	
2017	90	0.333	30	29	0.51	60	180	209	240	0.75	0.40	0.40	310	
Mean	**165**		**44**	**15**	**0.77**	**121**	**359**	**380**	**487**	**0.73**		**0.49**	**375.17**	Average All (1999 Included)
10-Year Mean	**149**		**45**	**14**	**0.76**	**104**	**408**	**422**	**512**	**0.79**		**0.48**	**375**	Average Last 10 years

Summar 2: Increased PNI, Increased escapement, Increased recruitment. In below average years will need to use safety net fish in broodstock and/or spawning grounds (may not be a bad thing).

Reduced Conservation Program and increased Safety-Net

Brood Goal	50			
Nason Creek Escapement Goal	542			
Target Extraction Rate	33%			
Conservation Program Size		**85,000**	**38%**	
Safety Net Program Size		**138,670**	**0%**	
		223,670		

Conservation Program:	SAR (BY2002-2011)		SAR (89-11)	
Mean HOR run size:	**413**	0.004864	**395**	0.00465
Minimum HOR runs size:	**261**	0.003076	**31**	0.00036
Maximum HOR run size:	**538**	0.006334	**1328**	0.01562
	10 year	**All**		
Mean HO R Needed	**444**	**426**		
Minimum HOR Needed	**502**	**509**		
Maximum HOR Needed	**533**	**570**		
Mean / Total Escapement	**542**	5420	**535**	**10179**
Mean/ Total Recruits	**393**	3933	**392.19**	**7452**
Mean PNI*	**0.50**		**0.52**	

***PNI Calcuated for the whole basin may be higher**

Year	Estimated Nason NOR Run Size at TWD	Target Extraction Rate	NOB	HOB	pNOB	Theoretical Escapement NOS	Theoretical Escapement HOS	Total HOR Needed From Conservation Program	Total Esc'nt	pHOS	PNITarget	PNI	Est. No. Adult NOR Recruits	2.96E-01 / 2.00E-03
1999	22	0.333	7	43	0.15	15	527	570	542	0.97	Any	0.13	393	
2000	223	0.333	50	0	1.00	173	369	419	542	0.68	0.50	0.59	393	
2001	294	0.333	50	0	1.00	244	241	291	485	0.50	0.67	0.67	384	
2002	347	0.333	50	0	1.00	297	245	245	542	0.45	0.67	0.69	393	
2003	193	0.333	50	0	1.00	143	399	399	542	0.74	0.50	0.58	393	
2004	297	0.333	50	0	1.00	247	233	233	480	0.49	0.67	0.67	383	
2005	83	0.333	50	0	1.00	33	509	509	542	0.94	0.40	0.52	393	
2006	118	0.333	50	0	1.00	68	474	474	542	0.87	0.40	0.53	393	
2007	82	0.333	50	0	1.00	32	510	510	542	0.94	0.40	0.52	393	
2008	139	0.333	46	4	0.93	93	449	453	542	0.83	0.40	0.53	393	
2009	164	0.333	50	0	1.00	114	428	428	542	0.79	0.40	0.56	393	
2010	59	0.333	20	30	0.39	39	503	533	542	0.93	Any	0.30	393	
2011	252	0.333	50	0	1.00	202	340	340	542	0.63	0.50	0.61	393	
2012	222	0.333	50	0	1.00	172	370	370	542	0.68	0.50	0.59	393	
2013	72	0.333	24	26	0.48	48	494	520	542	0.91	Any	0.34	393	
2014	199	0.333	50	0	1.00	149	393	393	542	0.73	0.50	0.58	393	
2015	145	0.333	48	2	0.97	97	445	447	542	0.82	0.40	0.54	393	
2016	143	0.333	48	2	0.95	95	447	449	542	0.82	0.40	0.54	393	
2017	90	0.333	30	20	0.60	60	482	502	542	0.89	0.40	0.40	393	
Mean	**165**		**43**	**5**	**0.92**	**122**	**405**	**426**	**535**	**0.75**		**0.52**	**392.19**	Average All (1999 Included)
10-Year Mean	**149**		**42**	**8**	**0.83**	**107**	**435**	**444**	**542**	**0.80**		**0.50**	**393**	Average Last 10 years

Current Program back-cast. Theoretical Nason Creek backcast (1999-2008) of broodstock, escapement, and PNI objectives.

NOR Brood Goal (Conservation Programs Only - Safety Net Excluded)	150 (76 Chiwawa, 74 Nason)			**Conservation Program:**	SAR (BY2002-2011)		SAR (89-11)		
Nason/Chiwawa Escapement Goal	1129			**Mean HOR run size:**	**1308**	0.004864	**1251**	0.00465	
NOR Target Extraction Rate	33%			**Minimum HOR runs size:**	**827**	0.003076	**97**	0.00036	
Combined Conservation Program Size (125K Nason, 144K Chi		**269,000**	**73%**	**Maximum HOR run size:**	**1704**	0.006334	**4202**	0.01562	
Nason Safety Net Program Size		**98,670**	**27%**		**10 year**	**All**			
		367,670		**Mean HO R Needed**	**613**	**702**			
				Minimum HOR Needed	**397**	**397**			
				Maximum HOR Needed	**997**	**1169**			
				Mean / Total Escapement	**1036**	10363	**1074**	**19907**	
				Mean/ Total Recruits	**1258**	12536	**1260.93**	**23958**	
				Mean PNI*	**0.63**		**0.58**		
				***PNI Calcuated for the whole basin may be higher**					

Year	Estimated NOR Run Size at TWD - whole basin	Target Extraction Rate	NOB	HOB	pNOB	Theoretical Escapement NOS	Theoretical Escapement HOS	Total HOR Needed	Total Esc'nt	pHOS	PNITarget	PNI	Est. No. Adult NOR Recruits	3.45E-01 / 4.61E-04
1999	110	0.333	37	113	0.24	73	1056	1169	1129	0.94	Any	0.21	1305	
2000	486	0.333	150	0	1.00	336	793	943	1129	0.70	0.50	0.59	1305	
2001	791	0.333	150	0	1.00	641	209	359	850	0.25	0.80	0.80	1154	
2002	628	0.333	150	0	1.00	478	472	472	950	0.50	0.67	0.67	1214	
2003	398	0.333	133	17	0.88	265	864	881	1129	0.76	0.50	0.54	1305	
2004	870	0.333	150	0	1.00	720	250	250	970	0.26	0.80	0.80	1225	
2005	222	0.333	74	76	0.49	148	981	1057	1129	0.87	Any	0.36	1305	
2006	234	0.333	78	72	0.52	156	973	1045	1129	0.86	Any	0.38	1305	
2007	239	0.333	80	70	0.53	159	970	1040	1129	0.86	Any	0.38	1305	
2008	335	0.333	112	38	0.74	223	906	944	1129	0.80	0.40	0.48	1305	
2009	469	0.333	150	0	1.00	319	810	810	1129	0.72	0.50	0.58	1305	
2010	476	0.333	150	0	1.00	326	803	803	1129	0.71	0.50	0.58	1305	
2011	1047	0.333	150	0	1.00	897	232	232	1129	0.21	0.80	0.83	1305	
2012	797	0.333	150	0	1.00	647	213	213	860	0.25	0.80	0.80	1160	
2013	486	0.333	150	0	1.00	336	793	793	1129	0.70	0.50	0.59	1305	
2014	744	0.333	150	0	1.00	594	535	535	1129	0.47	0.67	0.68	1305	
2015	549	0.333	150	0	1.00	399	401	401	800	0.50	0.67	0.67	1121	
2016	553	0.333	150	0	1.00	403	397	397	800	0.50	0.67	0.67	1121	
2017	282	0.333	94	56	0.63	188	941	997	1129	0.83	0.40	0.43	1305	
Mean	**511**		**127**	**39**	**0.76**	**385**	**679**	**702**	**1074**	**0.62**		**0.58**	**1260.93**	Average All (1999 Included)
10-Year Mean	**574**		**141**	**9**	**0.94**	**433**	**603**	**613**	**1036**	**0.57**		**0.63**	**1258**	Average Last 10 years

Summary of Option 1: This option has the potential to produces the lowest PNI, lowest Escapement, and lowest total Recruits. Hatchery returns are in excess of what is needed in all years.

Current Program back-cast. Theoretical Nason Creek backcast (1999-2008) of broodstock, escapement, and PNI objectives.

NOR Brood Goal	135 (76 Chiwawa, 59 Nason)			**Conservation Program:**	SAR (BY2002-2011)		SAR (89-11)		
Nason Creek Escapement Goal	1129			**Mean HOR run size:**	**1187**	0.004864	**1135**	0.00465	
NOR Target Extraction Rate	33%			**Minimum HOR runs size:**	**750**	0.003076	**88**	0.00036	
Combined Conservation Program Size (100K Nason, 144K Chiwawa)		**244,000**	**66%**	**Maximum HOR run size:**	**1545**	0.006334	**3811**	0.01562	
Nason Safety Net Program Size		**123,670**	**34%**		**10 year**	**All**			
		367,670		**Mean HO R Needed**	**603**	**691**			
				Minimum HOR Needed	**258**	**1042**			
				Maximum HOR Needed	**982**	**1154**			
				Mean / Total Escapement	**1042**	10418	**1077**	**20007**	
				Mean/ Total Recruits	**1262**	12572	**1264.21**	**24020**	
				Mean PNI*	**0.64**		**0.59**		

Year	Estimated NOR Run Size at TWD - whole basin	Target Extraction Rate	NOB	HOB	pNOB	Theoretical Escapement NOS	Theoretical Escapement HOS	Total HOR Needed From	Total Esc'nt	pHOS	PNITarget	PNI	Est. No. Adult NOR Recruits	**3.45E-01**
														4.61E-04
1999	110	0.333	37	98	0.27	73	1056	1154	1129	0.94	Any	0.22	1305	
2000	486	0.333	135	0	1.00	351	778	913	1129	0.69	0.50	0.59	1305	
2001	791	0.333	135	0	1.00	656	214	349	870	0.25	0.80	0.80	1166	
2002	628	0.333	135	0	1.00	493	482	482	975	0.49	0.67	0.67	1228	
2003	398	0.333	133	2	0.98	265	864	866	1129	0.76	0.50	0.56	1305	
2004	870	0.333	135	0	1.00	735	235	235	970	0.24	0.80	0.80	1225	
2005	222	0.333	74	61	0.55	148	981	1042	1129	0.87	Any	0.39	1305	
2006	234	0.333	78	57	0.58	156	973	1030	1129	0.86	Any	0.40	1305	
2007	239	0.333	80	55	0.59	159	970	1025	1129	0.86	Any	0.41	1305	
2008	335	0.333	112	23	0.83	223	906	929	1129	0.80	0.40	0.51	1305	
2009	469	0.333	135	0	1.00	334	795	795	1129	0.70	0.50	0.59	1305	
2010	476	0.333	135	0	1.00	341	788	788	1129	0.70	0.50	0.59	1305	
2011	1047	0.333	135	0	1.00	912	217	217	1129	0.19	0.80	0.84	1305	
2012	797	0.333	135	0	1.00	662	213	213	875	0.24	0.80	0.80	1169	
2013	486	0.333	135	0	1.00	351	778	778	1129	0.69	0.50	0.59	1305	
2014	744	0.333	135	0	1.00	609	520	520	1129	0.46	0.67	0.68	1305	
2015	549	0.333	135	0	1.00	414	386	386	800	0.48	0.67	0.67	1121	
2016	553	0.333	135	0	1.00	418	422	422	840	0.50	0.67	0.67	1147	
2017	282	0.333	94	41	0.70	188	941	982	1129	0.83	0.40	0.45	1305	
Mean	**511**		**117**	**30**	**0.80**	**394**	**673**	**691**	**1077**	**0.61**		**0.59**	**1264.21**	Average All (1999 Included)
10-Year Mean	**574**		**129**	**6**	**0.95**	**445**	**597**	**603**	**1042**	**0.56**		**0.64**	**1262**	Average Last 10 years

Summary of 2: increased PNI, increased escapment, increased recruitment

Current Program back-cast. Theoretical Nason Creek backcast (1999-2008) of broodstock, escapement, and PNI objectives.

NOR Brood Goal	126 (76 Chiwawa, 50 Nason)			**Conservation Program:**	SAR (BY2002-2011)		SAR (89-11)		
Nason Creek Escapement Goal	1129			**Mean HOR run size:**	**1114**	0.004864	**1065**	0.00465	
NOR Target Extraction Rate	33%			**Minimum HOR runs size:**	**704**	0.003076	**82**	0.00036	
Combined Conservation Program Size (85K Nason, 144K Chiwawa)		**229,000**	**62%**	**Maximum HOR run size:**	**1450**	0.006334	**3577**	0.01562	
Nason Safety Net Program Size		**138,670**	**38%**		**10 year**	**All**			
		367,670		**Mean HO R Needed**	**602**	**687**			
				Minimum HOR Needed	**413**	**1033**			
				Maximum HOR Needed	**973**	**1145**			
				Mean / Total Escapement	**1049**	10493	**1082**	**20132**	
				Mean/ Total Recruits	**1266**	12620	**1268.23**	**24096**	
				Mean PNI*	**0.64**		**0.60**		
				***PNI Calcuated for the whole basin may be higher**					

Year	Estimated NOR Run Size at TWD - whole basin	Target Extraction Rate	NOB	HOB	pNOB	Theoretical Escapement NOS	Theoretical Escapement HOS	Total HOR Needed From Conservation Program	Total Esc'nt	pHOS	PNITarget	PNI	Est. No. Adult NOR Recruits	3.45E-01
														4.61E-04
1999	110	0.333	37	89	0.29	73	1056	1145	1129	0.94	Any	0.24	1305	
2000	486	0.333	126	0	1.00	360	769	895	1129	0.68	0.50	0.59	1305	
2001	791	0.333	126	0	1.00	665	225	351	890	0.25	0.80	0.80	1179	
2002	628	0.333	126	0	1.00	502	473	473	975	0.49	0.67	0.67	1228	
2003	398	0.333	126	0	1.00	272	857	857	1129	0.76	0.50	0.57	1305	
2004	870	0.333	126	0	1.00	744	256	256	1000	0.26	0.80	0.80	1241	
2005	222	0.333	74	52	0.59	148	981	1033	1129	0.87	Any	0.40	1305	
2006	234	0.333	78	48	0.62	156	973	1021	1129	0.86	Any	0.42	1305	
2007	239	0.333	80	46	0.63	159	970	1016	1129	0.86	Any	0.42	1305	
2008	335	0.333	112	14	0.89	223	906	920	1129	0.80	0.40	0.52	1305	
2009	469	0.333	126	0	1.00	343	786	786	1129	0.70	0.50	0.59	1305	
2010	476	0.333	126	0	1.00	350	779	779	1129	0.69	0.50	0.59	1305	
2011	1047	0.333	126	0	1.00	921	208	208	1129	0.18	0.80	0.84	1305	
2012	797	0.333	126	0	1.00	671	229	229	900	0.25	0.80	0.80	1185	
2013	486	0.333	126	0	1.00	360	769	769	1129	0.68	0.50	0.59	1305	
2014	744	0.333	126	0	1.00	618	511	511	1129	0.45	0.67	0.69	1305	
2015	549	0.333	126	0	1.00	423	427	427	850	0.50	0.67	0.67	1154	
2016	553	0.333	126	0	1.00	427	413	413	840	0.49	0.67	0.67	1147	
2017	282	0.333	94	32	0.75	188	941	973	1129	0.83	0.40	0.47	1305	
Mean	**511**		**111**	**25**	**0.82**	**400**	**672**	**687**	**1082**	**0.61**		**0.60**	**1268.23**	Average All (1999 I
10-Year Mean	**574**		**121**	**5**	**0.96**	**452**	**597**	**602**	**1049**	**0.56**		**0.64**	**1266**	Average Last 10 ye

Summary

- Reducing the program can result in more fish on the spawning grounds (marginally)
- Adjust the escapement goal has greater potential to increase escapement and recruitment – this should be done at the same time or in conjunction with adjustments to the conservation program size
- Need updated prespawn mortality data and habitat capacity info to update the escapement goals
- Composite broodstock was not modeled in 2009 but appears to give us better flexibility in adjusting the conservation program size, however because Chiwawa program hatchery fish and NORs cannot reliably be used for Nason Creek spawning escapement the Nason only model may be more appropriate.
- All parties would need to support potentially regular use of safety net fish in broodstock and on spawning grounds.

Background information for determining the Brood Year 2019 marking strategy:

Brood year 2019:

Program	Origin	Number per origin as of April 2020
Chiwawa Conservation	WxW	55,172
	HxH	70,973

The following tagging scheme was decided during the March 2019 HC meeting for Brood Year 2018 Nason and Chiwawa conservation and safety-net programs:

Program	Number as of March 2019	Origin	Adipose Mark	Snout Mark	Body Mark
Chiwawa Conservation	49,927	WxW	Ad +	CWT	None
	124,297	HxH	Ad +	CWT	Caudal BWT
Nason Conservation	110,327	WxW	Ad +	None	Dorsal CWT[a]
	14,600	HxH	Ad +	CWT	Caudal BWT
Nason Safety-Net	115,637	HxH	Ad -	CWT	None

Note:

a. Prior to 2016, Nason Conservation Program WxW fish were marked with a snout CWT and a caudal CWT.

A brood year 2018 caudal BWT marked fish (picture taken during PIT-tagging March of 2020).