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Review of the Monitoring and Evaluation Plan for the Walla Walla Spring Chinook Hatchery Master Plan *(public review draft)*: Response Requested

Step Two of the Northwest Power and Conservation Council's Three-Step Review Process

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Contents

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Background

In response to the Northwest Power and Conservation Council's June 1, 2015 request, the ISRP reviewed the *Monitoring and Evaluation Plan for the Walla Walla Spring Chinook Hatchery Master Plan* (public review draft, March 2015). The draft monitoring and evaluation plan (M&E Plan) was produced by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) for two BPA-funded projects: *Walla Walla River Basin Monitoring and Evaluation (M&E)* (#2000-039-00) and the *Walla Walla Spring Chinook Hatchery Master Plan* (Project #2000-038-00, *Final Design/Construction)*.

As described in the Master Plan, the goals of the CTUIR (the project proponents) for Walla Walla Subbasin spring Chinook are to provide treaty and non-treaty fisheries in the basin and to reintroduce a naturally spawning and productive population. The purpose of the proposed hatchery is to develop a population of spring Chinook adapting to local conditions, as well as to contribute to a sustainable harvest and natural spawning in the near-term. This is to be done in a manner consistent with the longer-term goal of re-establishing a self-sustaining, naturally spawning population through an "all-H" approach[1] that includes hatchery production and improvements to in-channel habitat and to fish passage. The program is designed to end the current dependence on imported broodstock, improve survival through local adaptation, and meet harvest and natural spawning objectives. Implementation is proposed to occur in three phases, moving from one phase to another based on the performance of hatchery and naturally spawning fish in the South Fork Walla Walla River, Touchet River, and Mill Creek.

This Step Two Review submittal of a draft M&E Plan is intended to address the condition placed on Project #2000-038-00 as part of the Council's October 8, 2013 recommendation associated with the Step One Review of the Master Plan:

> *"The Council recommends that the Walla Walla Spring Chinook Hatchery Master Plan proceed with Step 2 activities. This recommendation is subject to the requirement that the CTUIR fully address the comments raised by the ISRP (ISRP document 2013-12[2]) as part of the Step 2 submittal."*

[1] An All-H approach involves hatchery production, harvest management, habitat improvement, and hydropower operation as part of a comprehensive mitigation strategy.

[2] For the complete ISRP Step One review history of the Master Plan also see ISRP 2013-10, ISRP 2010-17 and ISRP 2008- 14.

As described in the Executive Summary of the draft M&E Plan, the purpose of the draft is to describe a Plan that:

> *"addresses the adaptive management requirements of CTUIR's proposed spring Chinook Program, and maintains the baseline monitoring needed by the existing management system. This plan describes an ecosystem-based, scientific framework for adaptive management of spring Chinook. It includes a definition of the system for performance evaluation based on measurements of success and monitors of risk to other species and populations."*

The ISRP's review below provides a series of overall recommendations to improve the next draft of the M&E Plan, followed by a summary of how the proponents responded to ISRP issues raised as part of the final Step One recommendation (ISRP 2013-12), and then additional recommendations specific to each chapter of the submitted draft M&E Plan.

ISRP Recommendation

Response Requested

Recommendation 1. Revise and restructure the document to present a Monitoring and Evaluation Plan that 1) identifies and then links specific performance metrics for each program phase, including assumptions, uncertainties, and Decision Rule criteria; and, 2) integrates the overall approach with specific field sampling methodologies and analytical approaches in the river and the hatchery.

The proponents present an M&E Plan to monitor status and trends of spring Chinook salmon in the Walla Walla Subbasin associated with the Walla Walla Hatchery Master Plan (WWHMP). The M&E Plan will evaluate the effectiveness of expanded artificial production of spring Chinook salmon and other All-H activities in the subbasin aimed at reaching productivity goals that will support harvest and ultimately natural-sustained reproduction. The M&E Plan provides an important retrospective analysis of actions taken in the subbasin over the past 15 years or so, and it demonstrates a considerable ongoing effort in this regard. However, some critical elements are missing. The ISRP concludes that details on proposed protocols, methods, and metrics need to be explicitly presented in the plan. Without this information, the scientific merits of the plan cannot be fully evaluated. To assist the proponents, the ISRP identifies the following issues and offers some specific guidance on how each can be addressed. If requested, the ISRP review team will participate on a conference call to answer questions and clarify issues associated with this review.

The WWHMP proposes to develop an expanded hatchery program for spring Chinook salmon in the subbasin consisting of three phases. The first phase focuses on establishment of a local broodstock to be maintained for use within the subbasin. It is expected that this localization will dispense with the need to continually import juveniles or brood fish from the Carson National Fish Hatchery. If successful, the resulting population will be influenced by and adapt to local conditions within the subbasin and its migratory corridor. The second phase will operate in a manner that increases both natural and hatchery production to meet demographic targets for returning adults. Achieving these targets will permit

harvest of adults, secure a source of brood fish for artificial production, and provide escapement for natural spawning. The final phase will augment opportunities for natural selection by increasing Proportionate Natural Influence (PNI) on both brood fish and spawners on redds.

The steps used for moving from one operational "Phase" to the next are based on a set of Decision Rules defined in the Master Plan. These Decision Rules require inputs such as productivity from Beverton-Holt productivity models, Viable Salmonid Population (VSP) parameters, and PNI. Therefore, a rigorous and transparent approach to account for natural and hatchery production and productivity throughout the life-cycle (eggs to adults) is warranted. In the present draft, it was not clear how abundances of adult and juvenile Chinook salmon (both natural- and hatchery-origin) will be estimated because 1) the percentage of fish marked and released at the hatchery was not directly stated, and 2) the method and sample sizes needed to develop estimates based on only a fraction of marked hatchery fish was not described. Similar uncertainties for estimating the productivity of wild fish warrant more detailed description.

Moreover, setting quantitative objectives (or benchmarks) for decision rules requires consideration of ecological conditions both within and outside of the subbasin as these conditions will affect survival and ecosystem capacity—and some are beyond the control of the CTUIR. Such uncertainties also require a rigorous accounting and more detailed description than is currently provided (see specific comments below). Finally, an accounting of conditions and performance within the hatchery will also be needed. The M&E Plan would be more complete if it described how specific data needs for Decision Rule Criteria are connected to its measureable benchmarks. These benchmarks should be directly linked to specific methods or protocols (including intensity of measurement, assumptions, sources of bias, and infrastructure needs) and statistical or analytical approaches.

Because the plan will guide M&E activities for the next 10-20 years, it is important that this document be designed to link all the necessary pieces of the Master Plan in a scientifically defensible manner. This means that an M&E plan should be designed to address uncertainties (where such information does not yet exist) and to evaluate overall effectiveness. This linkage is necessary to meet the Council's Fish and Wildlife Program's (as amended in 2014) request for rigorous biological monitoring and evaluation programs to facilitate adaptive management in the Columbia River Basin. The design and approach of an M&E plan along with the program's assumptions, methods (including any infrastructure, equipment, and specialized skills), analyses, and proposed reporting are pivotal for evaluating the success. An effective M&E plan will also provide data that are directly connected to a program's adaptive management process. M&E plans that the ISRP has judged to "meet scientific criteria" are robust in design and link performance metrics with 1) objective benchmarks critical to adaptive management decisions for the basin and 2) periodic evaluations based on reporting of results for individual programs. The ISRP recommends that the proponents refer to a few of the plans that have met scientific criteria, such as the Confederated Tribes of the Colville Indian Reservation's Chief Joseph M&E Plan for Summer/Fall Chinook Salmon and the Nez Perce Tribe's Johnson Creek Artificial Production Evaluation. These are available through the Northwest Power and Conservation Council and the project managers for those projects.

The ISRP recognizes that it is impractical to measure and analyze every imaginable variable. Instead, we seek an M&E Plan that identifies metrics that measure variables or parameters linked to the program's

broader performance, management decisions and measurable objectives (see L. McDonald et al. 2007, for a general discussion). The present version of the WWHMP's M&E Plan includes some of these elements. However, the structure and organization of the current M&E Plan requires additional attention. The proponents indicate the plan's "approach of describing process rather than technique will bring best available science and scientific methods to the project…" (Section 1.3, para 3). The ISRP concurs with and supports bringing the best science and methodology to the project. This approach of describing process, however, obscures the details of how metrics will be measured and analyzed to inform the three-phase framework for the program. Moreover, the Plan leaves important gaps in describing which metrics will be included to test assumptions, how programmatic uncertainties will be addressed, and how the larger overall population-level performance goals of the program will be evaluated.

Recommendation 2. Summarize and report results (i.e., those presented largely in Subsection 1.6) within the context of the metrics important for evaluating the program's assumptions and uncertainties.

The proponents chose an approach that is premised on "process rather than technique" (p. 2), suggesting this approach will ensure a better scientific foundation and greater collaboration within the program. In doing so, the document summarizes biological data from ongoing studies and population monitoring in the subbasin and points to methods and protocols standardized in the Pacific Northwest Aquatic Monitoring Partnership's (PNAMP) compendium of standard methods. Unfortunately, the result is a document that lacks critical details. It is disconnected in terms of proposed actions (i.e., artificial production) and rigorous measurements of their effects. As such, the ISRP found it difficult to align proposed protocols, methods, and metrics with the specific data and analysis requirements proposed for the program. To facilitate its review, the ISRP requests that the presentation be revised to directly connect each of the key metrics with its rationale, methods, assumptions, and results of previous work.

Recommendation 3. Provide measurable objectives (performance criteria or benchmarks) for each of the key metrics along with management hypotheses.

This recommendation is challenging because it requires some thought as to what constitutes success. For the metrics that directly inform the decision rule set, this is perhaps most straight forward because it sets a PNI and a target for smolts to be released. These and other targets within the hatchery environment are often easier to account and control, while those in the natural environment can be more challenging. Regardless, to be effective the M&E Plan should identify all benchmarks objectively and quantitatively. For example, is it realistic to achieve 5,500 adults (or 4,300 or some other range of returns as a 3-year geometric mean of natural origin plus hatchery origin fish, or all natural origin fish)? What restoration efforts in the watershed have been or will be undertaken to reach the proposed target? Is it expected that this goal could be achieved after completion of the steelhead 20-year restoration plan? Ultimately, if this level of recruitment (as a longer term goal) is expected, it will likely vary along with future ecological conditions and with escapement from harvest. The ISRP again requests

that the goals for returning adults be justified and shown to be scientifically plausible under current or future ecological conditions.

Recommendation 4. Provide the specific methods to collect and analyze data for the key metrics.

The ISRP requests presentation of the specific methods used to gather M&E data needed for the Decision Rules, for Beverton-Holt productivity modeling of the natural population, for determining environmental conditions in the watersheds, and for assessing in-hatchery performance. Some of the methodology and protocols were referenced to PNAMP's MonitoringMethods.org site. While the ISRP endorses standardization and more uniform monitoring efforts throughout the basin, publication and peer-review of these methods and protocols are incomplete. Additionally, even the most standard methodologies and protocols will likely be modified to fit the idiosyncrasies of the subbasin. In such instances, these changes should be documented and rationales provided. Moreover, as a standalone document intended to support the WWHMP, the M&E Plan will be a primary reference for program staff and cooperators for many years to come. We anticipate that these methods will be published in a timely manner. However, for completeness and immediate reference the ISRP recommends that the protocols and methods to be used either be directly inserted into the plan or presented as an appendix.

Recommendation 5. Provide additional information on the program's assumptions and uncertainties.

A number of assumptions are associated with the program including, for example, Carson strain Chinook salmon will adapt to local conditions and continued habitat actions will increase carrying capacity. There are also several uncertainties of questions concerning, for example, relative success of natural v. hatchery produced smolts, proportion of strays in and out of the subbasin, and the extent to which density dependence will constrain productivity as adult returns reach the proposed target (see Recommendation 7 below). While it is not possible to identify all of the project's assumptions and uncertainties, some consideration and discussion of the most salient of these should be included in the Plan. Moreover, how these uncertainties will be identified and prioritized in the future is a key element of an adaptive management framework.

While the proponents have a record of reporting and analyzing results from other projects, inclusion of statistical and analytical approaches specific to this program are necessary. The section on Existing Conditions includes estimates for a number of metrics that the M&E plan will measure. There is an opportunity to report on the adequacy of current effort (such as trapping infrastructure and methods) for basic metrics such as number and size of juveniles produced (from hatchery and natural sources), smolts produced per natural spawner, natural and hatchery adult returns by age, out of basin strays, jacks, mini-jack production, and others. Adequacy of the current trapping infrastructure and methods to meet proposed M&E requirements needs to be demonstrated. If these efforts are not sufficient, this section provides an opportunity to propose upgrades or inclusion of new methods. For example, downstream smolt trapping appears to account for approximately half of the juveniles released. It is important to determine whether this discrepancy indicates low survival (perhaps due to low ecosystem capacity) or estimation error associated with the trapping methodology.

The ISRP requests a better description of the precision and accuracy required for each performance standard under an appropriate section (e.g., performance in the natural environment, performance in the hatchery, ecological condition, and so on depending on final structure). It is especially important to include a description of methods and additional requirements (i.e., equipment, infrastructure, and personnel) for measuring proposed metrics that are not presently measured.

Recommendation 6. Broaden consideration and discussion of Adaptive Management for spring Chinook in the Walla Walla Subbasin.

During each Phase of the program the adaptive management component of the plan needs to use empirical data to evaluate uncertainties (see Recommendation 5 above). Essential uncertainties include the extent to which SAR may increase by developing locally adapted broodstock and the rate of adaptation to the natural environment; the extent to which ongoing habitat restoration will mitigate density effects on productivity (density dependence) and increase carrying capacity of spring Chinook in the subbasin; and the expected rate of harvest in all three phases. For example, how might the number of fish released from the program be adjusted (in terms of production and release) if fish are returning but are not being harvested at expected rates? Specific rules for program adjustments need to be established in the plan.

Recommendation 7. Account for the effects of density dependence during each phase of the program and how this consideration and appropriate actions may lead to greater harvests and improved adaptation of natural Chinook to the local environment.

Chapter 2 provides evidence of density dependence during the spawner to smolt stage (e.g., Fig. 11). For example, the predicted number of smolts per spawner at high spawner abundances (1100 spawners, the Phase 2 target) is approximately 26 smolts per spawner. Predicted number of smolts per spawner, however, increases to approximately 77 smolts per spawner at 300 spawners and to 150 smolts per spawner at 100 spawners. In contrast, given an assumed Smolt-to-Adult Return (SAR) of 0.35% (Fig. 17), smolts per spawner must be approximately 285 or more to meet or exceed replacement (R/S = 1). Please see ISAB (2015-1; Figure VIII.1) for more discussion of this density dependence issue. Fig. A (below) provides an example of a plot of smolts per spawner in relation to the number of parent spawners in the Walla Walla subbasin.

The apparent density dependent relationship for naturally spawning spring Chinook in the Walla Walla subbasin suggests an opportunity for increasing harvests of surplus hatchery fish while also minimizing pHOS and therefore promoting the development of locally adaptive traits by the natural Chinook population. Consider the following scenario. For example, if 1,100 fish spawn naturally, approximately 100 natural-origin fish would return (assuming 26 smolts per spawner and SAR = 0.35%). In this example R/S is only approximately 0.091 and pHOS would likely be greater than 90% assuming 10% of NOR fish are taken for broodstock. However, if additional hatchery fish (HORs) were to be selectively harvested such that only approximately 300 Chinook spawn, then R/S would increase to approximately 0.27 or an approximate 3-fold increase. In this example, pHOS would decrease to approximately 76%, which is not

ideal but better than 90%, and additional Chinook could be harvested (assuming hatchery releases remain constant). Additionally, if fewer salmon spawn, juvenile Chinook may grow faster in the river (as a density dependent growth response which should be evaluated in the Plan) and this may increase the SAR of natural smolts so that pHOS might be further reduced. Note that when productivity and habitat capacity to produce salmon are evaluated, harvests are typically added to those fish returning to the river. Future M&E efforts should strive to incorporate harvests into the return estimates of natural adult Chinook so that life-cycle changes in capacity and productivity can be accurately evaluated.

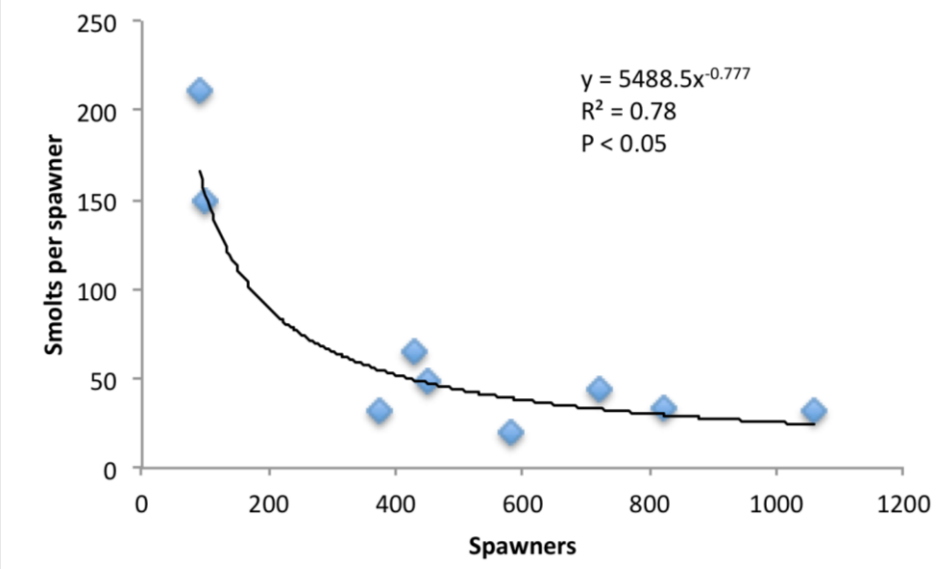

Fig. A. Smolts per spawner in relation to the number of parent spawners in the Walla Walla subbasin. Values approximated by eye from Fig. 11 of the M&E report.

Recommendation 8. More fully address and integrate previous review "qualifications" from the Step One reviews.

The ISRP also examined the document for evidence that previously identified issues and comments had been addressed. These issues are summarized as follows.

1. Clarifications of the basin goals and the purpose of the hatchery program

a. *"Clear definition of these goals and desired future condition is not a trivial undertaking in the Step Review process as the goals frame the set of assumptions that apply to the proposed program (specifically, for segregated-harvest v. integrated-harvest v. conservation)."*

The Step Two, M&E Plan clearly states that the program is designed to operate as an integrated-harvest hatchery program during phase three.

b. *"Clear articulation of the goals, in turn, influences the decision-rules and objectives (measurable benchmarks) against which the program can be evaluated within an adaptive management*

context. The latter will be an essential component of a monitoring and evaluation plan (M&E plan) to be detailed in the Step 2 submittal."

The Step Two M&E Plan did not adequately communicate the recommended *"measurable benchmarks."* (See Recommendation 3, above). Furthermore, a number of biological targets in Table 2-1 appear to have changed considerably from Step One to Step Two without explanation. For example, 1) the escapement target increased from 1,100 to 1,500 in Phase 1 in spite of apparent density dependence at lower levels, 2) HOR out-planting targets increased substantially from 50-450 to 150-860 fish, and 3) no limits for pHOS are described for Phases 1 and 2. Because the WWHMP was not revised between Steps, these targets are conflicting and need thorough explanation.

c. *"… the Step 2 submittal should continue to address the linkages to specific plans for habitat and other improvements."*

These linkages and description were only generally described. Specifically, the ISRP requests that the proponents describe what progress have partners/collaborators within the Subbasin made toward restoring ecological conditions capable of supporting 5,500 adults (NORs + HORs or 5,500 NORs)? Also, if present capacity on the spawning grounds or capacity to support smolts appears insufficient, how will restoration actions (or production targets) be changed? The ISRP requests additional detail (or analysis) on what it will take in terms of ecological conditions to reach these targets.

d. *"… the M&E plan should include methods to attain reliable estimates of the number of hatchery-origin fish in the natural spawning escapement and to quantify trends and yearly fluctuations in carrying capacity in the Subbasin as habitat and watershed improvements are completed."*

The Step Two M&E Plan did not specifically address methods for estimating total NOS and HOS escapement to the spawning grounds; existing spawner counts were reported as indices of abundance. At a more general level, much of the M&E program relies on mark and recapture methods to provide a suite of population and life-history estimates. A description of the operation and adequacy of the equipment used to trap fish should be included in the M&E Plan. Furthermore, the Plan should describe how it will identify and estimate abundances of hatchery versus natural origin salmon.

e. *"It will also be critical for the M&E plan to include metrics to assess and adaptively manage risk posed by the hatchery program."*

The risks posed by the hatchery program to non-target species within the basin and to neighboring spring Chinook populations were not addressed adequately. For example, risks to non-target steelhead and bull trout are assumed to be negligible. While this assumption may prove to be correct, it merits direct examination. If this task will be undertaken by other projects or co-managers, the Plan should indicate this. For other neighboring populations of spring Chinook salmon in the basin, how will straying of Walla Walla hatchery salmon be accounted for and addressed? Will straying rates differ if they are natural or of hatchery origin?

2. Additional information on hatchery production levels and estimates of productivity for each of the three phases

a. *"How do the proposed or anticipated levels of pre-terminal and in-basin harvest comply with US v. Oregon targets under the current agreement?"*

The relationship of the proposed production to US v. Oregon targets is not addressed.

b. *"… a return of 4300 adult spring Chinook salmon with 2400 intended for harvest and 1900 for natural spawning. It is unclear how these goals were established."*

The proponents provided a response in Table A.1 that refers to figures in Subsection 1.6, but they did not substantiate how these targets were developed. The resulting level of targeted return is not obvious. As such, the ISRP is not confident in the potential for this level of return even after significant habitat restoration. Restoration actions needed to achieve this large increase in salmon production should be described and linked to specific restoration actions.

c. *"The ISRP is concerned about the size of the proposed program relative to the capacity for hatchery production, not just in the facility, but afterwards in the Walla Walla River Subbasin."*

Capacity in the subbasin is currently limited by ecological conditions but can potentially be increased through actions to improve Chinook habitat. These actions are discussed only generally. The Plan should explicitly identify habitat actions and their expected benefits that will help achieve goals of the plan, such as the goal of 5,500 NOR Chinook. This information would help the ISRP determine whether the NOR Phase 3 goal of 5,500 Chinook is achievable. Also, the Plan should state whether these NOR goals include harvests of fish in the terminal area and downstream in the Columbia River. The M&E plan should acknowledge that these goals are "uncertainties" and clearly describe how the goals will be reevaluated based on empirical data obtained from proposed monitoring. Similarly, reevaluation of goals should be included as an element in the adaptive management decision framework, with consideration of how revision of the goal would affect proposed levels of production, harvest, pHOS, and so on.

d. *"Ultimately, such trade-offs in allocating NORs to brood stock versus the natural spawning grounds is a key operational decision affecting the development of a local stock that needs to be addressed in Step 2."*

These trade-offs are discussed only generally. There are multiple combinations of increasing NOB and NOS or decreasing HOB and HOS that can increase PNI. While the M&E Plan should address how these will be measured and analyzed as an operational issue, there remains a gap in how the information will be used to make decisions about breeding and escapement. The proponents are referred to other supplementation efforts, such as in the Yakima watershed, where 100% of the broodstock are from NORs, pHOS is near 50%, leading to a somewhat high PNI value (Fast el al. 2015). For the purposes of M&E, however, the ISRP seeks an approach to address this trade-off to permit reaching pNOB > 50% without sacrificing pNOS and ultimately the PNI of the subbasin.

e. *"Balancing the goal of local adaptation against that for harvest and total adult production that is maintained with imported eggs is not explicitly treated in the Step 1 or the Response Submittal and should be addressed in the M&E plan provided in Step 2."*

The issue is addressed in the Step Two M&E plan only generally. The response matrix covers this in a superficial way. Increased productivity from creating a population and breeding stock adapting toward local conditions is a key assumption (and uncertainty) of this program. This assumption warrants closer examination. For example, what is proposed in the Plan if hatchery broodstock abundance were not sufficient to meet the release target of 500,000 smolts? To what extent might Carson Hatchery fish be used? As described below, the program may need to consider selective harvest of surplus hatchery salmon as a means to reduce density dependence and enable greater potential adaptation by the NOR population.

f. *"… potential integration and future program reduction are significant issues that need additional consideration and discussion."*

The Step Two M&E Plan indicates that operation as an integrated-harvest hatchery program is a desired future operational condition (in Phase 3). Conditions allowing or requiring program reduction or cessation are covered only generally. The framework for the spring Chinook program proposes a release of 500,000 hatchery-produced smolts and 1,100 to 1,500 adults for natural spawning. Data presented in the current status section of the M&E plan suggest that hatchery smolt emigration from the Walla Walla subbasin is only about half of the current release of 250,000 smolts, although it is acknowledged that smolts may have been underestimated. Such high losses might indicate that the carrying capacity of the watershed is limited by ecological conditions, in which case doubling release rates (as proposed) might not double (and in fact could decrease) the number of outmigrants. Empirical support is lacking that the watershed can support these fish release numbers and the targeted spawning escapement (carrying capacity given current ecological conditions). This uncertainty needs to be addressed in order to evaluate whether a smaller program might yield the same result in terms of NOR and harvest, and also might have a larger PNI with improved adaptation.

3. Expected duration of the two initial phases

No specific information is provided beyond the previous response that decision rules, controlling the duration of each phase, will be based on condition (i.e., value of performance metrics) rather than a prescribed time frame. The ISRP remains skeptical that an open-ended program is a scientifically supportable approach. Goals must be credible and attainable (see previous comments).

4. Additional clarification on the relative importance of the decision rules and guidelines that will be used to transition from one phase to the next

a. *"… maintaining the population as a "demographic safety net" – especially for Mill Creek and the Touchet River"*

The issue was not adequately addressed in the Step Two M&E plan. Specifically, what a *"demographic safety net"* is and its role in the broader goal for the program needs to be described.

b. *"The Step 2 document would be improved if the decision rules that governed the production of Figures A-2a and A-2b were accompanied by additional description and discussion."*

The program overview and summary did not expand on the discussion of the decision rules and how they would be implemented. For example, it is not clear how decision rules regarding total abundance (e.g., Phase 1 spawning target: 1,500 NOR & HOR) can be met when the existing M&E program does not account for all Chinook (see Fig. 2 footnote). Methods to expand the index count were not described.

5. Choice of Broodstock

No additional rationale was provided for choosing the Carson "strain" of spring Chinook salmon. Moreover, a description is needed of metrics or methods to examine possible local alternative stocks.

Additional Comments and Responses Requested on Specific M&E Plan Sections

Additional comments provided hereafter are specific to the sections as they were presented. Some will be reiterations or expansions of the larger points (Recommendations) presented above.

In the Introduction, the background and purpose sections of the plan are sufficient. The "Overview" (Section 1.3) provides a description of the planning approach. This section includes the perspective contained in the statement, *"We believe that our approach of describing process rather than technique will bring best available science and scientific methods to the project by holding collaboration central to the M&E planning process."* The ISRP appreciates this perspective and also seeks delivery of the best science and methodology, but the ISRP suggests this approach leaves important gaps in the M&E plan. Which metrics, for instance will be used to test assumptions, address uncertainties, and evaluate the overall population-level performance of the program? This approach may also obscure how metrics are measured and analyzed to inform the three-phase framework for the program. Also, details on methods to maintain metric accuracy and precision are often missing. Therefore, additional specifics are needed.

ISRP Recommendation: To provide the context for this M&E plan as a stand-alone document, the proponents should provide an expanded summary of their proposed three-phase program in the "Program Summary" narrative (Section 1.4). This summary could be cut and pasted from the revised and latest version of the WWHMP. Some detailed comments on Chapter 1 are noted below.

Historic and Existing Conditions (Sections 1.5 and 1.6) include presentations of the current status of spring Chinook salmon, steelhead, and bull trout as a demonstration of the kinds of analyses that will be used to evaluate the hatchery program, and thus, they provide an indication of the kinds of metrics and data that will be collected by the M&E Plan. These results also shape some of the program's assumptions (e.g., stock-recruitment necessary to achieve objectives for each phase) and provide a more objective depiction of the subbasin's capacity and productivity over the recent decade. However, the Existing Conditions section does not include all the metrics that are needed for decisions and

adaptive management. The section would benefit by describing how key metrics would be used to (a) assess how the Chinook program is progressing and (b) help the adaptive management process. Additionally some discussion on how metrics such as smolt counts and total adult counts will be improved or will be expanded is important for demonstrating a comprehensive program.

In the description of the watershed (Section 1.6.2), a short list of watershed restoration actions is provided without any description of how each is expected to increase capacity in the subbasin. Moreover, stated on page 8, *"…the Subbasin has gone from highly degraded to one that can support an integrated spring Chinook program.*" As defined by the Hatchery Scientific Review Group (HSRG), an *integrated* program will require a self-sustaining Chinook population. The statement is therefore an assumption that can and should be tested by the M&E Plan. The Plan should describe how it is linked to restoration efforts that can increase spring Chinook to 5,500 NOR, i.e., the ultimate program goal. Do restoration efforts in the subbasin share the goal of 5,500 NOR Chinook (i.e., a goal of the Subbasin Plan)? The feasibility of achieving this objective in concert with significant and realistic restoration activities should be discussed. Also, the Plan should state whether these NOR goals include harvests of fish in the terminal area and downstream in the Columbia River.

The Plan indicates that current in-basin conditions satisfy the Phase 1 requirements for natural productivity, yet Figure 2 shows that adult returns are well below the Phase 1 target of 1,500 spawning Chinook in all years. Some supporting discussion on why the proponents believe Phase 1 requirements have been met would clarify this conclusion. Without more justification or supporting analyses, the ISRP remains unconvinced that the current (and expected future) carrying capacity in the subbasin may be sufficient for the proposed strategy. Density dependence could reduce survival such that releasing additional hatchery fish does not yield a corresponding increase in the total number of out-migrating smolts. For example, Figure 6 conveys that recent releases of nearly 250,000 smolts have resulted in only about 100,000 out-migrating smolts (implying approximately 40% survival). If 40% survival is an underestimate due to sampling bias, as suggested, then this bias needs to be addressed through a strategy to reduce the estimation bias. Likewise, adjustments need to be made to accurately estimate natural smolt production and total natural spawners so that the number of smolts produced per natural spawner (NOS) can be estimated and linked back to habitat restoration efforts and hatchery production. On the other hand, if survival has been estimated accurately, then 60% mortality is cause for concern, and actions need to be taken to identify and rectify the causes.

Density dependence should be evaluated more comprehensively in the M&E effort. The text on page 13 suggests that the linear relationship between redd counts and spawners is evidence of an absence of density dependence. However, only 0.4 redds per spawner are produced at 1,000 spawners, whereas 0.6 redds are produced per spawner when only 200 spawners are present. Figure 7 suggests (although it might not be statistically significant) that the abundance of natural smolts declines with increasing abundance of hatchery smolts. Figures 11, 12, and 13 also provide some evidence of compensatory density dependence. The number of smolts per spawner should be plotted in relation to the numbers of spawners or redd counts (see Figure A above). Figure 16 provides evidence of compensatory density dependence across the life cycle, plus it is noteworthy that R/S is typically less than one indicating the natural population is currently unable to sustain itself at existing harvest rates. Quantification of density dependence in the Walla Walla subbasin is important because it can constrain recovery and limit the

shift toward an integrated hatchery approach, which requires a sustainable natural population (R/S > 1, on average). Attempts to provide spawner abundances near or above the Beverton-Holt capacity estimate by using large hatchery releases (up to 500K) to provide hatchery fish spawning in nature will reduce productivity (i.e., both adult R/S and smolts per spawner). Scaling the program to a smaller spawning population may enable productivity to increase, which may promote adaptation of the population to its habitat. Collection of data on smolt growth could help to identify any limitations caused by food production in the watershed; if growth is density dependent, then restoration efforts could target rearing habitat and prey production.

On pages 16-17 (Figures 11 to 14), the plan stated that productivity meets Phase 1 expectations. These expectations are not clearly shown in these figures. How do the estimated levels of intrinsic productivity (nearly 293 smolts per spawner) compare with values for other populations in the Columbia Basin? ISAB (2015-1) shows that the intrinsic productivity of aggregate Snake River spring/summer Chinook, an ESA-listed population, is 389 smolts per female spawner. Current conditions in the watershed appear to be limiting capacity for the population. For example, Figure 13 demonstrates that only 28 smolts per spawner were produced from approximately 1,180 pre-spawners whereas 100 smolts per pre-spawner are predicted to occur at 200 pre-spawners. If SAR has been estimated at approximately 0.5% in recent years, as shown in Figure 14, then the number of smolts per spawner must be 200 to reach replacement (R/S = 1). Thus, as described by ISAB (2015-1, Fig. VIII.1), additional habitat restoration is needed to increase capacity and productivity, or else, survival through the hydrosystem and into the ocean must be increased. Figure 16 indicates that R/S (measured as adult to adult) exceeded replacement in only 1 of 9 years (2005); S in that year was the lowest value in the time series. Because density dependence has been inferred by fitting stock recruitment curves, the proponents should explain why they believe that current productivity is sufficient to meet requirements for a program that aims to further increase spawning density (to 1,500 spawners in Phase 1). As a caveat, the plan offers (at the bottom of page 18) that the life-cycle performance estimates should not be strictly interpreted as the estimates of habitat productivity and capacity because some adult recruits are underestimated by being intercepted in harvests and under-counted. Regardless of such uncertainties, smolt per spawner estimates are much lower than what is needed to achieve a viable population. The Plan should attempt to estimate harvests and incorporate these estimates in stock-recruitment relationships so that productivity and capacity of the natural Chinook population can be adequately monitored in response to ongoing restoration activities.

The text on p. 20 concluded basin capacity is sufficient to meet WWHMP goals, and the proponents are very encouraged by the apparent increase in capacity during recent years. This conclusion needs better justification. For example, approximately 155 fish are expected to return to the river (after harvests) from 1,032 spawners. Productivity (R/S) is about 0.15 for the entire period of record, increasing to nearly 0.28 during 2006-2008, a period when survival at sea was relatively high. To what extent has more favorable, but perhaps temporary ocean conditions led to the reported apparent increase in capacity in recent years? All the productivity values presented are exceptionally low. Life-cycle productivity (and number of smolts per spawner) could be somewhat improved if the escapement target was smaller than the Phase 1 target of 1,500 or the Phase 2 target of 1,100 fish. A smaller escapement target could thereby enable a somewhat lower pHOS and potentially allow for some adaptation of the natural stock to the habitat.

Non-target species:

Steelhead. The ISRP appreciates that the proponents provided information on non-target species to provide a broader ecosystem context. Density dependence of steelhead should be evaluated. For example, what is the relationship between the number of steelhead smolts per spawner and total spawners, and adult return per spawner versus spawners? To what extent do hatchery releases of steelhead contribute to density dependence? Density dependent growth and age at smoltification should be examined. See ISAB (2015-1) for examples of steelhead density dependence in the Umatilla basin and Clackamas River. The proponents suggest that juvenile steelhead do not compete with spring Chinook for resources, but this assumption should be tested as part of the monitoring and evaluation effort, especially since hatchery steelhead are released into the basin.

Bull trout. The numbers of bull trout migrating upstream are shown to have increased steadily from 1999 to 2013 (fitted line in Figure 33). However, the caption to Figure 33 indicates that the counting effort only became consistent when a new ladder and trap was constructed around 2008. Is it possible that numbers were so underestimated prior to 2009 that the trend has actually been declining since 2004? It would help to know whether the 2008 data point were "prior to" versus "included in" the recent consistent time series (new ladder and trap). This underscores the need for full presentation of methods.

Other considerations:

Is the term dispensatory a typo? ("…dispensatory effect of hatchery fish on naturally reared fish"). Perhaps the authors meant depensatory (as opposed to compensatory)? Figs. 11 and 7 suggest mortality of natural smolts may be compensatory rather than depensatory. A plot of smolts per spawner in relation to spawners would help identify this function as either compensatory or depensatory (see ISAB 2015-1, Fig. II.1). If mortality was depensatory, predators might be the source of depensation, but the figures do not seem to support a depensatory relationship.

In a few places within the Plan correlation analyses are presented (e.g. hatchery vs. natural out-migrant survival, survival of hatchery v. natural out-migrants to McNary Dam, and others) and trend lines and r^2 values are provided. The proponents used the slope of the trend line, without the corresponding p-value, to infer a relationship where one may not exist. The proponents should determine the p-value of the relationships they have examined before concluding or speculating on why it may exist.

Please check to make sure all references are provided in the Literature Cited section. For example, County 2004 and Council 2014 reportedly estimated that historical runs of spring Chinook and steelhead exceeded 20,000 per year. The accuracy of this 20,000 fish estimate is important because it suggests a high level of abundance when habitat conditions were more favorable. Unfortunately, these references were not included in the Literature Cited section. Other citations are also missing and these omissions indicate that a thorough proof-reading is warranted.

The assumed values in Table 2-5 (p. 22) and decision rules in Table 2-2 (p. 23) need clarification and additional explanation. Beverton-Holt parameters for intrinsic productivity and capacity appear to have been estimated using assumptions within EDT, but in later sections it is not obvious how these estimates will be applied to the program, especially, in deciding whether the population is productive enough to

allow the transition from Phase 1 to 2. Applicable here are previous comments focusing on the role of density dependence (in a resource limited system) and how a smaller target spawning population may lead to higher productivity of the natural population. We see a potential problem in achieving a predicted (or perhaps assumed) spawning capacity estimate of 1032 adults in the system (or even larger numbers of spawners) because that will require exceptionally high pHOS values if productivity (R/S) is performing well below replacement (currently at 0.15 to 0.28). Thus, there appears to be a trade-off between achieving targeted spawner abundances with high pHOS vs achieving sufficient PNI for an integrated-harvest program. Selective harvest of surplus hatchery fish could rectify this issue while also contributing to harvest goals.

It is unclear in the plan what percentage of juvenile Chinook overwinters in the basin versus emigrates as subyearlings to overwinter upstream of McNary Dam (see Fig. 20) and to what extent these subyearling and yearling strategies contribute to adult production. Studies in the Snake River subbasin by Copeland and Venditti (2009) and Copeland et al. (2014) have observed this behavior (see ISAB 2015-1), leading them to suggest that subyearling emigrants were important to population recovery. How are habitat restoration actions in the Walla Walla subbasin targeting life history types, especially those that emigrate downstream as subyearlings? It seems Table 3 needs to be modified to reflect this diversity, as it only mentions yearling smolts.

2 OBJECTIVES AND RATIONALE

General Comments for Sections 2 and 3 are provided to address some specifics of the document's individual subsections in addition to the overarching comments provided above. At this point the Plan begins to get disjointed by separating Objectives and Rationale from Methods. For the ISRP, a preferred presentation is to identify and outline critical data and analytical needs to inform management decisions (i.e., metrics) and carry each through from description and use, to identification of benchmark, to assumptions and precision, to method, to analysis.

2.1 Monitor and evaluate salmonid performance in the natural environment.....p. 51

The proponents state they will collect and assemble data on adult returns (including NOR and HOR), smolt to adult ratios for smolts released from the program, redd counts, timing and size of the run, and other Beverton-Holt parameters within the subbasin. Out-of-basin monitoring depend on other basin-wide efforts from tagging and harvest reporting (e.g., US v. Oregon activities).

While the sub-strategies listed on page 51 generally cover the primary areas of uncertainty and measures needed for population assessment, the ISRP requests the proponents describe specific methods of collecting data in the field, approaches to analyzing the data, quantitative benchmarks for interpreting (evaluating) results, and how the evaluation will be used for program modification or improvement. One obvious gap is a sub-strategy to assess ecological capacity. Another gap is a more accurate estimate of total abundances of NOR and HOR Chinook salmon. The existing program shows that the accounting is an index not a complete count (Fig. 2). There may be other gaps we failed to identify, thus we recommend stating metrics and methods that will meet information or decision needs.

In Table 9 (page 48) the second column lists key management hypotheses that will be evaluated. The same three hypotheses are being used to evaluate the effect of the project on (a) fish abundance, (b) survival, (c) growth, (d) morphology, (e) carrying capacity, (f) spatial distribution of redds, and (g) life history expression in the natural environment. The hypotheses are (a) that an increase has occurred, (b) a decrease has occurred, and (c) that there will be no increase. Further explanation is needed on how changes in morphology will be assessed. For instance, to evaluate changes in morphology of natural origin fish due to the project, the genetic history of an examined juvenile or adult would need to be known. Was it produced by a naturally spawning hatchery fish or did it originate from natural origin parents and were shape changes related to its genetic origin? In this instance, decreases and increases in certain portions of the body may contribute to an overall difference in morphology.

2.2 Monitor and evaluate performance of the hatchery system.....p 51

The parameters being measured at the hatchery to evaluate in-hatchery performance are largely complete. However, the ISRP recommends the addition of three additional assessments that could take place just prior to smolt release. First, even though pathogen monitoring is scheduled to occur during the rearing period it would also be valuable to perform a general health exam on the smolts just prior to their release. This assessment may prove useful when evaluating post-release performance such as migration rate, in-river survival, and SAR values as pathogens may affect fish performance. It is likely that several hundred fish would need to be sacrificed to perform this work.

Second, an important metric that the project should consider measuring is the occurrence of minijacks. The maturation status of the fish used in the pathogen assessments could be assessed to determine the incidence of early male maturation in project fish. The most sensitive test to determine precocious development is to measure plasma levels of the reproductive steroid 11-ketotestosterone (Larsen et al. 2004). Alternatively, a method described by Campbell et al. (2003) can be used to determine the gonadosomatic index (GSI) of sampled males. This method is not as accurate as the plasma assay, but it can be done by simple dissection and weighing. And, like the plasma method, it will give an estimate of the percentage of males that are likely to become minijacks. Knowing the percentage of males that have adopted this life history strategy will help the proponents develop SARs, SAS, and R/S values on hatchery fish that did not mature at age 1+ (i.e., it will provide them with the number of true smolts that left their facility). This procedure might also shed light on the apparently high rate of loss of hatchery smolts (nearly 60% loss) enumerated at the downstream trap. Additionally minijacks may residualize and compete for food and space with other stream salmonids. Consequently, their presence could affect the carrying capacity of the Walla Walla subbasin and influence the growth rates and size of naturally produced spring Chinook and resident fishes. Thus, having an estimate of their abundance should help the proponents evaluate the impact of the project on natural origin fishes.

Third, it is also suggested that morphometric measurements be made on a sample of hatchery smolts and on the adults used as broodstock (see Busack et al. 2007). Changes in morphology caused by exposure to hatchery conditions could be quantified as deviations from the shape of naturally produced fish at both the juvenile and adult stage. The measurements taken on wild smolts and adults would serve as baselines for such comparisons. This would allow the proponents to determine if hatchery fish differ in shape at the juvenile and adult stages and what parts of the body may have been altered by exposure to hatchery conditions.

The BPA sub-strategies on page 52 are not linked or associated with the performance parameters in Table 9 on page 49. The methods presented on pages 73-79 are aligned with the performance parameters on page 49. How these performance parameters and associated standards could be used to "Evaluate the effectiveness of hatchery safety-net/conservation programs and the effectiveness of hatchery reform actions on the achievement of biological performance objectives" (sub-strategy 1) as an example, is not provided. It is not clear whether this program will, or can, assess these BPA sub-strategies. If the program is not going to address these sub-strategies it would be better to remove them from the plan because in that circumstance they are a distraction. Inspection of the project summary at CBFish.org states that there are no associations with this project and the BiOp. It is not clear why the Bonneville sub-strategies are included in the M&E plan if they are not linked with a performance parameter.

2.3 Monitor and evaluate ecological conditions 52

The WWHMP relies on an EDT approach to assess habitat quality and to indicate the carrying capacities of the South Fork Walla Walla, Touchet River, and Mill Creek. Therefore, these are working hypotheses for the watershed. The foundation for ultimately transitioning to Phases 2 and 3 depends greatly on achieving access (passage) and habitat improvements (including flows, spawning, and nursery habitats) within the watersheds of the subbasin. Consequently, monitoring these conditions is essential for evaluating a response to planned improvements. Section 3.4 (and especially Table 13) outlines the essential monitoring—with reference to PNAMP protocols and methods.

Ultimately, the text on Subsection 2.3 is confusing when taken together with the same topics in Methods Section 3. In this section, the plan states that systematic surveys of habitat are not needed because they have been completed over the last decade. This suggests habitat conditions will not change (improve or degrade) to any meaningful extent. How then, are we to expect increased natural capacity? The paragraph goes on to state that ecological information will be provided by collaborators and evaluated by the proponent. The need for ecological information seems critical to understanding changes in carrying capacity and density dependence and learning if restoration implemented for steelhead under the BiOp is achieving realized improvements for aquatic species.

The project is responsible for providing funds to partners who will collect streamflow and temperature data. The proponent's role will be to compile the data and analyze them. Extensive fish passage assessments have occurred in the past; however, future passage studies are not outlined or proposed. The project will not perform habitat fieldwork but will reportedly work closely with CHaMP, ISEMP, and BPA's AEM program to ensure that stream habitat assessment work is conducted. Specific entities that will be implementing the CHaMP, ISEMP, and AEM protocols should be identified. Possible effects of the project's phases 1, 2, and 3 on water temperature, flow, habitat attributes, fish passage, and stream connectivity or network structure will be assessed by testing three hypotheses. Additional information on Chinook habitat attributes and "stream network structure" that will be evaluated by these entities is warranted.

The proponents indicate they will contribute to an annual cycle of reporting performance (quarterly) for technical information and an annual programmatic performance review of all M&E activities. This latter report will include a public presentation for interested stakeholders. The ISRP suggests that the Council's Fish and Wildlife staff and the ISRP and ISAB would benefit from periodic briefings on these activities.

The proponents are collaborating with personnel from the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) to identify and use established methods and metrics that can be employed by the project. In a number of instances new protocols, methods, and metrics are needed. Once these new procedures have been described and housed at the PNAMP web page links between them and project's reports can be used to indicate how data were gathered and analyzed. For completeness and ease of understanding, however, the reports should include details on how work was accomplished and how data were analyzed rather than just a link to a PNAMP protocol or method. Idiosyncratic adjustments may be necessary to make a method suitable for the project. If this occurs, such changes should be clearly indicated. Using the Streamnet Data repository to obtain harvest data on project fish is appropriate and efficient.

The use of a relational database for the information generated by the project is appropriate and should prove useful to the proponents when they analyze and report on the progress of this project. Quarterly reporting will provide the proponents with information they can use to assess risks and evaluate progress toward meeting project objectives. The reporting approach appears to be adequate and will likely play an important role in the adaptive management process they are proposing to use.

The proponents outline a four-step annual decision-making process of M&E activities. Such reviews of key metrics, followed by analysis of uncertainties and assumptions are iterative and necessary to close the loop with a science-based decision step. Importantly, each essential uncertainty (i.e., capacity and density-dependence, selection for local stocks, harvest, and adaptation to the natural environment) needs to be integrated into the adaptive management framework.

As the primary operating plan for guiding M&E activities for the next 10-20 years, it is critical that the plan have a firm scientific foundation (where previous information is available) and is designed to address uncertainties and evaluate effectiveness (where such information does not yet exist). Moreover, Council's Fish and Wildlife Program (as amended in 2014) requires a rigorous biological monitoring and evaluation program as a foundational pillar of adaptive management in the Columbia River Basin. As such, the general monitoring design and approach, the program's assumptions, methods (including any infrastructure, equipment, and specialized skills), analyses, and reporting are not only pivotal for evaluating success of the program but also for directly informing the decision rules and overall framework of the proposed program outlined in the Master Plan.

When applied to conservation projects, adaptive management possesses three components that need to be integrated. First, assumptions about various actions need to be tested in a systematic fashion in order to achieve a desired outcome. The actions that are implemented are not chosen at random but rely on previously gained knowledge to pick the best strategy. Efforts are then made to collect

monitoring data to see if the assumptions behind the action are warranted. Second, the process must accommodate and alter management based on new or different information that is obtained through the monitoring process. And third, the process must be designed to take advantage of learning, not only from information derived from the project but also from other similar conservation actions.

The approach taken for project management and administration appears to be appropriate. The proponents have a track record of administering large projects that include M&E components.

A foundational statement on page 55 is confusing and further explanation is required: "*Rather than providing an exhaustive list of possible null and alternative hypotheses, we developed a road map between the Monitoring Objectives presented by the HMP and ongoing natural production requirements, and the Methods that will be adaptively managed in collaboration with PNAMP and the co-managers.*" This statement implies that Adaptive Management will be directed toward the M&E Methods (in addition to the resource?). The ISRP is not sure this is what the proponents meant to say.

The ISRP seeks further clarification on the proponent's approach outlined on page 55 that states, *"Rather than seeking to inform the HMP decision rules directly …"* The ISRP agrees with the role and need for M&E discussed later in the paragraph. Moreover, we agree there is more to the M&E enterprise than simply addressing the Decision Rules. However, we do not fully comprehend why these preclude informing the decision rules as measurable objectives. The entire framework is based on the Decision Rules and this implies a formal data-driven decision model.

Unfortunately, the approach presented in the current version of the Plan does not permit an acceptable level of review by the ISRP. The specific methods and an evaluation of their efficacy in the Walla Walla need to be provided. The "existing conditions" section and links in Methods tables are not amenable to independent evaluation. This document will serve as long-standing guidance for Walla Walla HMP M&E, and needs to be thorough. In a decade or so, technicians, biometricians, and managers not yet on staff, will need this documentation to understand the program they have inherited (see the Recommendation 1 above for a more detailed description).

Ultimately, much of the population monitoring relies extensively on tracking individuals migrating in and out of the subbasin throughout their life cycle. Therefore, it is worthwhile to describe the mark and recapture strategy and trapping/detection network proposed. This should include necessary improvements and weaknesses that have led to undercounts.

The proponents correctly acknowledge (on page 56) the limitations of the Before-After (BA) design being proposed, but they do not adequately explain why they have not proposed (or been able to propose) an alternative design that does include control sites (i.e., Before-After-Control-Impact or BACI) or a statistical analysis that could take advantage of any post-hoc contrasts.

Table 10 presents a broad array of performance estimates across the salmon's life cycle. The specific methods for acquiring data to achieve these estimates are largely absent. It is difficult to determine if these estimates are or will be sufficient for program evaluation purposes. Level of effort (i.e., annual v. continuous v. a single sampling) and sampling area that will be used to develop these estimates should be described, for example.

Most of the essential metrics for constructing a local run are included in Table 11. However, a description is needed in the plan to indicate that the subbasin infrastructure is sufficient to accomplish this or what sampling regimen is needed to collect data (i.e., count smolts and adults from hatchery, wild, and neighboring sources) and to perform the analysis.

Monitoring in the natural environment will include genetic identification, but why it is essential is not presented. Table 11 appears to state that fish will be evaluated from Lower Granite Dam. But the Walla Walla is a Columbia River tributary below the confluence of the Snake River. Why this location is appropriate is not evident (e.g., does it address possible straying risks?).

Table 12 and text in the M&E plan describe how in-hatchery performance of project fish will be evaluated. The parameters targeted for measurement are appropriate and the work appears to be comprehensive. However, like the effort to evaluate performance in the natural environment much remains to be done. At the PNAMP website, all four protocols are drafts that are 22% complete and the methods that will be employed to assess water use and quality are all in the draft stage (15% complete). Conversely, the project was able to utilize PNAMP methods that were previously published to evaluate egg production, broodstock size (fork length and body weight), and number of hatchery smolts produced. Other biological aspects, e.g. hatchery/wild composition of the broodstock, spawn timing, pathology and mark/tag assessments remain in draft form. These should not take too long to complete. As mentioned above any text associated with planned protocols and methods should be placed into an appendix or directly incorporated into the M&E plan where it can be easily examined.

Table 12 indicates that some of the data gathered from monitoring in-hatchery performance attributes will be presented in histograms. Histograms can be a useful way to visually present data. However, for this type of effort we recommend that tables populated with mean and variance values be used. Information in this form along with a database of the raw data will be of more value to the project and can be used to create histograms and compute confidence intervals on relevant parameters.

We have a number of suggestions that the proponents may wish to consider adopting in this portion of their M&E plan beyond the three already mentioned (pathology screening at release, morphometric assessments of juveniles and adults plus detection of early maturation in juvenile males). First, sex determination in immature spring Chinook can be problematic. Recently some Columbia Basin projects

are using portable ultrasound units to determine sex in broodstock.[3] The method is quick and highly accurate and would give the project a reliable estimate of the sex ratio of its prospective broodstock. Second, having a good estimate of the number of eggs taken is obviously important as that original egg count will be used to estimate such parameters as egg-to-eyed egg, egg-to-fry, and egg-to-smolt survival rates. We suggest that fecundity estimates be determined gravimetrically for every female used as broodstock. There can be quite a bit of variation in fecundity and egg size due to age at maturation, body size, and other factors. Collecting this type of information will also allow the project to track trends in fecundity and egg size over time and permit comparisons between natural- and hatchery-origin females. Third, BKD is ubiquitous in Columbia River Chinook salmon and care must be taken to manage its occurrence in a hatchery setting. ELISA (enzyme-linked immunosorbent assay) methods should be performed on all the female broodstock to detect high carriers of the bacteria. Eggs from these females can be culled if the eggs from each female are incubated separately from one another until the eyed stage. If automatic egg counters will be used it is important to validate their counts. This step was not mentioned—it can be accomplished by hand counting several thousand eggs and running them through the counter. A number of spring Chinook supplementation hatcheries exist in the Columbia Basin, and we recommend that the proponents visit a few of them to see how in-hatchery performance is being measured. A good place to start would be the Cle Elum Supplementation Research Facility operated by the Yakama Nation. They are using ultrasound units to determine sex on their broodstock, taking morphometric measurements on adults, determining individual fecundities at the time of spawning, using "iso-buckets" to keep the eggs from each female separate until the results of ELISA tests are complete, assessing the occurrence of precocious parr and performing other in-hatchery assessments.

The hatchery performance evaluation should include numbers of hatchery fish contributing to all fishery harvests, including harvests in the watershed and in the Columbia River. Performance should be evaluated against quantitative objectives, but there is no mention of these objectives.

The M&E Plan does not specifically state the percentage of fish that will receive external fin clips. It does say 20% of smolts will have CWT and 5,000 will have PIT tags. A high percentage of externally marked hatchery smolts will be necessary to accurately estimate pNOB in the hatchery and pHOS in the river. The plan should explain how it will quantify these two critical metrics given the proposed rates of fish marking.

3.4 Monitor and Evaluate ecological conditions 80

Table 13 provides a broad list of characteristics in the subbasin. The proponents outline a suite of characters such as temperature profile, hydrograph (instream flow), and physical habitat complexity. The stated expectation is that these *"conditions will improve through time."* This assumption needs to be tempered because the subbasin will likely be impacted by human population growth, out of channel land use changes, and climate change. Additionally, details on the protocols and methods that will be

[3] The proponents should contact staff at Cle Elum Supplementation Research Facility (CESRF) for additional information.

utilized to perform the work are lacking and need to be completed. All of the protocols in the PNAMP site for this part of the project are drafts; however, many of the methods (7/11) have been published and the remaining ones are close to being complete.

The proponents mentioned in Table 13 that all the environmental attributes collected by habitat programs and projects operating in the Walla Walla subbasin will be assembled and summarized by using a library of attribute definitions and conversion methods. No other information about this process is provided; more details are needed for completeness.

Who will document cumulative restoration actions over time in the subbasin, how will this be done, and will the entire subbasin be monitored? What are the conditions for the 20-year steelhead habitat restoration? It is reportedly assumed that the actions will restore 50% of the production loss between current habitat conditions and those modeled for properly functioning conditions (p. 81). Given this assumption, would the goal of 5,500 NOR spring Chinook be achieved at this time? If not, is 5,500 NOR a realistic goal for this effort? What specific monitoring is being done to evaluate quality and quantity of spawning habitat and rearing habitat? What are the specific metrics that will be measured in the Habitat Assessment Task and how will this relate back to Chinook abundance and productivity?

Clarification is needed to reconcile section 3.4.3 Instream Habitat (page 80) with section 2.3 Monitor and Evaluate Ecological Conditions (page 52). These sections need integration and transparent alignment. Section 2.3 states that habitat inventory and status assessment is not needed. Section 3.4.3 states habitat surveys will be conducted by other agencies and used by CTUIR in the spring Chinook program adaptive management modeling. The ISRP needs to know the parameters that are needed in the modeling (presumably to estimate capacity and productivity) and whether the necessary data will actually be collected in the anticipated surveys.

It is important to note that EDT addresses habitat productivity and capacity in a qualitative rather than empirical fashion. As such, productivity values based on EDT are really predictions that need to be validated. It is not clear how estimates from habitat modeling will be used in WWHMP adaptive management. EDT analysis might be used to assist in comparing likely benefits from alternative habitat improvements, but this is not discussed in the M&E plan. Will EDT output be evaluated or compared with empirical estimates of productivity and capacity that should stem from the M&E Plan?

The final paragraph in section 3.4.3 indicates that some CHaMP data will be collected, but in a restricted area. It is not clear from the text how the Rainwater area can be scaled up to the entire Walla Walla subbasin. The M&E plan should also discuss how CHaMP habitat data will be incorporated into the adaptive management decision process since both the HMP and M&E plan emphasize that habitat improvements are required for success of the spring Chinook program.

The final paragraph on page 81 describes the role of steelhead performance (status and trends) for evaluating effectiveness of habitat actions. Ultimately, steelhead are proposed to be a suitable proxy for capacity and overall condition at this time (until spring Chinook become more widespread and established). This proposition also underscores the need for considering non-target species monitoring, not only for their use as surrogate indicator species, but also as potential competitors, etc.

See comments in section 2.5. Annual and technical reports, plus an annual workshop along with the data management steps outlined in the M&E plan should allow results to be communicated in an effective manner.

See comments under Section 2.6.

Figure 37 on page 86 is a copy of the figure from the Step One HMP, but the text of the four adaptive management steps on page 87 do not easily follow the text in the boxes in figure 37.

The four step process appears to be modified from the In-Season Management Procedure (ISMP) developed in the Chief Joseph Hatchery M&E plan and also used by Idaho Department of Fish and Game in the Springfield Sockeye Hatchery M&E plan. The modification is primarily switching step 2 and step 3. The purpose of the modification to the Chief Joseph and Springfield M&E ISMP format in the Walla Walla plan should be explained. Moreover, the modifications do not appear complete and warrant a thorough proofreading.

The text on page 87 is confusing. For example: "Step 1 of the process will begin each quarter *following* the review of in-season biological targets." Should this read "begin each quarter *with* the review of"? If the process really is "following," then whatever preceded Step 1 needs to be presented. The specific biological targets being referenced need to be identified. There is no text that identifies that key assumptions can be changed, although it is implied. But the process for revising key assumptions (i.e., levels of evidence, statistical basis, and so on) needs to be included. It would seem logical that this would be part of Step 1.

Step 2 in the text primarily discusses updates to Decision Rules, but in Table 37 these updates are listed as Step 3. Here, data need to be collected, validated, status and trends updated, and an operating plan developed annually. However, adaptive management in regard to evaluating key assumptions, updates to decision rules, and decisions on program size, judgment of success or failure, and movement through phases might be conducted realistically on a 3 to 5 year time frame. This difference needs to be incorporated into the plan.

Table 14 presents production performance parameters for adaptive management that have not been introduced earlier in either the natural or hatchery production sections. It seems that the adaptive management performance parameters should be the same as those used in assessing the natural and hatchery production. It is not clear why relative reproductive success information is needed and how it will contribute to evaluation of the key assumptions or determining program success. Effective population size is important and perhaps should be an estimated metric. It should be presented in one of the earlier sections. Relative reproductive success is of interest, and perhaps something new would be learned in Walla Walla spring Chinook. But how the results would be interpreted and used to inform the decision rules are not discussed. Spring Chinook relative reproductive success is being evaluated in other locations in the Columbia Basin by other Fish and Wildlife Program projects. CRITFIC has a substantial effort underway to evaluate relative reproductive success in reintroduced Chinook salmon

and coho. Justification is needed for undertaking such an effort for reintroduced spring Chinook in the Walla Walla.

Project Administration is largely outside the scope of the ISRP review except as it applies to delivering on the scientific elements and performance requirements. The proponents outline a general collaborative approach among co-managers for target and non-target species management and associated M&E program. Specific focus on the spring Chinook salmon performance over the next 12-20 years will be the responsibility of the proponents. The ISRP recommends a tighter linkage between M&E for this project and related projects (e.g., habitat) in the Walla Walla subbasin contributing to basinwide data-sharing.

Literature Cited

Busack, C., K. M. Knudsen, G. Hart, and P. Huffman. 2007. Morphological differences between adult wild and first-generation hatchery upper Yakima River spring Chinook salmon. Transactions of the American Fisheries Society 136:1076-1087.

Campbell, B., J.T. Dickey, and P. Swanson. 2003. Endocrine changes during onset of puberty in male spring Chinook salmon, *Oncorhynchus tshawytscha*. Biology of Reproduction 69:2109-2117.

Copeland, T., D.A. Venditti, and B.R. Barnett. 2014. The importance of juvenile migration tactics to adult recruitment in stream-type Chinook salmon populations. Transactions of the American Fisheries Society 143:1460-1475.

Copeland, T., D.A. Venditti. 2009. Contribution of three life history types to smolt production in a Chinook salmon (*Oncorhynchus tshawytscha*) population. Canadian Journal of Fisheries and Aquatic Sciences 66:1658-1665.

Fast, D.E., W.J. Bosch, M.V. Johnston, C.R. Strom, C.M. Knudsen, A.L. Fritts, G.M. Temple, T.N. Pearsons, D.A. Larsen, A.H. Dittman, and D. May. 2015. A synthesis of findings from an integrated hatchery program after three generations of spawning in the natural environment. North American Journal of Aquaculture 77:377-395.

Independent Scientific Advisory Board. 2015. Density dependence and its implications for fish management and restoration programs in the Columbia River Basin. ISAB Document 2015-1. Prepared for the Northwest Power and Conservation Council. http://www.nwcouncil.org/fw/isab/isab2015-1

Larsen, D.A., B.R. Beckman, K.A. Cooper, D. Barrett, M. Johnston, P. Swanson, and W.W. Dickhoff. 2004. Assessment of high rates of precocious male maturation in a spring Chinook salmon supplementation hatchery program. Transactions of the American Fisheries Society. 133:98-120.

McDonald, L.L., R. Bilby, P.A. Bisson, C.C. Coutant, J.M. Epifanio, D. Goodman, S. Hanna, N. Huntly, E. Merrill, B. Riddell, W. Liss, E.J. Loudenslager, D.P. Philipp, W. Smoker, R.R. Whitney and R. N. Williams. 2007. Research, Monitoring, and Evaluation of Fish and Wildlife Restoration Projects in the Columbia River Basin: Lessons Learned and Suggestions for Large-Scale Monitoring Programs. Fisheries 32: 582-590.