Attachment 4. Response to public comments received in response to 80 FR 15984 (March 26, 2015) specifically regarding the 4(d) PEPD for a RMP encompassing early winter steelhead HGMPs operating in the Dungeness, Nooksack, and Stillaguamish River watersheds.

Comment #1 (Wild Fish Conservancy (WFC)): NMFS should decline to approve the joint plan because the HGMPs do not meet 4(d) Rule Limit 5(i)(A) criteria requiring that the plans have clearly stated goals, performance objectives, and performance indicators indicating the purpose of the program, its intended results, and measurements of its performance in meeting those results. The commenter states that the three HGMPs do not provide specific information regarding specific methods and parameters evaluated to identify genetic effects, nor what actions will be taken when target levels of genetic diversity are not attained.

Response: The PEPD provides sufficient rationale for a determination that the HGMPs address this Limit 5 criterion. The document provides a detailed explanation regarding why the proposed HGMPs meet criteria requiring that the plans have clearly stated goals, performance objectives, and performance indicators that indicate the purpose of the programs, their intended results, and measurements of their performance in meeting those results.

As indicated in the PEPD, goals, performance objectives (standards), and performance indicators for early winter steelhead (EWS) hatchery and associated monitoring and evaluation actions are clearly described in sections 1.7, 1.9, and 1.10, respectively of each HGMP. As described in section 1.7 of each HGMP, the hatchery program goals are to: (1) provide regional non-Indian recreational fishing opportunities, and (2) support Jamestown S'Klallam, Lummi, Nooksack, and Stillaguamish tribal Treaty-reserved fishing rights and commercial, ceremonial, and subsistence needs. Performance standards and indicator defining intended results are clearly described in section 1.9 and 1.10 of each plan. In those sections, eight performance standards are described to address program benefits, and 18 performance standards are described to address program risks. Performance standards described in section 1.10 to address benefits of the HGMP pertaining to primary HGMP objectives are: "Program contributes to fulfilling tribal trust responsibility mandate and treaty rights as described in applicable agreements (U.S. v Washington)"; "Program contributes to mitigation requirements" and, "Program addresses ESA responsibilities". Example performance standards described in section 1.10 to address risks to listed fish species are: "Life history characteristics of the natural population do not change as a result of this hatchery program"; "Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production"; and, "Collection of broodstock does not adversely impact the genetic diversity of the naturally-spawning population." For each of these two performance standard categories, performance indicators and responsive monitoring and evaluation actions are included with each standard to describe how achievement of each standard will be determined, and whether the standard is met through HGMP implementation.

Contrary to the commenter's statement, and as indicated by the example standards described above addressing risks, specific standards, indicators, and monitoring and evaluation actions addressing genetic diversity reduction risks to natural steelhead populations are clearly described in the Executive Summary and in section 1.10 of each HGMP. Information regarding the

genetic effects of each program, how genetic diversity of natural steelhead populations will be preserved, and monitoring and evaluation actions that will be taken to measure effects are included in HGMP sections 2.2.2 and 11.0. As described in the Executive Summary of each HGMP, genetic effects of the hatchery programs on natural-origin steelhead will be assessed through measures of introgression and the proportion of effective hatchery contribution derived directly through DNA analysis, using parameters and methods described in the Warheit 2014 and Hoffman 2014 documents referenced throughout the HGMPs. The Warheit method-based DNA analyses will rely on periodic tissue sampling of key steelhead demographic/tributary groups, consistent with the Anderson et al (2014) document that is also referenced in the HGMPs. Performance indicators bearing on measurement of genetic effects will be estimated using genetic samples collected from the natural populations and hatchery-origin fish straying to natural spawning areas. Given the proposed risk averse changes in how the programs are implemented, and considering proposed direct measurement of introgression and gene flow, the HGMPs maintain as goals significant reductions in hatchery-related genetic impacts on natural origin populations from past levels, and maintenance of genetic introgression effects at negligible to very low levels. As indicated in the Executive Summary, section 1.10, and section 2.2.2, it is the intent of the HGMPs to monitor, identify, and maintain these negligible to low genetic impact goals during implementation of the plans. The commenter does not provide a single literature citation in support of their claim otherwise.

Comment #2 (WFC): NMFS should decline to approve the HGMP because the plans do not meet 4(d) Rule Limit 5(i)(B) criteria requiring that they utilize the concepts of viable salmonid populations.

Response: As stated in the PEPD, NMFS's assessment is that the HGMPs utilize and are consistent with VSP concepts. They are designed in consideration of their effects on VSP parameters (i.e., natural population abundance, productivity, diversity, and spatial structure) and on the viability status and viability goals for ESA-listed natural populations of salmon and steelhead. The viability status of the listed salmon and steelhead populations that may be affected by the programs is reported in section 2.2.2 of each HGMP, and thoroughly detailed in the PEPD. In these documents, the current viability status of each listed population is compared with VSP goals developed for use in listed population recovery planning. For example, for listed steelhead, recent abundance estimates are compared with Distinct Independent Population (DIP) abundance goals developed by the Puget Sound Steelhead Technical Recovery Team (PSTRT). The PSSTRT developed these goals for each natural steelhead population that may be affected by the programs in each watershed (Hard et al. 2015). The viability goals finalized by the PSSTRT in 2015 will be used by NMFS as recovery targets in the Puget Sound DPS recovery plan currently under development. Section 2.2.2 also presents evaluations of the effects of each proposed EWS program on the genetic diversity status of natural steelhead populations. The results presented indicate the programs would have negligible to low effects on the diversity status of any natural steelhead populations. Further, a full reading of this limit 5 criterion indicates that it is primarily directed at hatchery programs that would purposefully remove listed steelhead or salmon for use as hatchery broodstock. NMFS included this criterion in limit 5 of the 4(d) Rule to ensure that such actions take into account the VSP status of the population that would serve as donor stock. None of the EWS HGMPs propose to remove listed steelhead from

the natural steelhead populations for use as broodstock, and the programs therefore comply with this criterion by default.

Comment #3 (WFC): NMFS should decline to approve the HGMP because the plans do not meet 4(d) Rule Limit 5(i)(E) criteria requiring that the plans evaluate, minimize, and account for the program's genetic and ecological effects on natural populations, including disease transfer, competition, predation, and genetic introgression caused by the straying of hatchery fish. Particular concerns expressed by the commenter are that the proposed EWS steelhead programs: do not adequately acknowledge the risk of fitness loss; do not consider appropriate monitoring and measures to detect and avoid fitness loss impacts; and, do not address impacts of fisheries targeting hatchery steelhead on wild steelhead.

Response: The PEPD provides sufficient rationale for a determination that the plans address this Limit 5 criterion. As described in the PEPD, all of the proposed HGMPs evaluate, minimize, and account for the propagation program's genetic effects (section 2.2.2) and ecological effects on listed fish populations. Consistent with this criterion, the plans include best management practices (BMPs) proposed to account for and minimize hatchery-related effects with regards to fish health (HGMP sections 1.10; 2.2.3; 5.8; 7.7; 7.8; 9.16; 9.27; 9.2.10; and 10.9), broodstock collection (sections 1.10; 1.11; 2.2.2; 5.0; 6.2; 6.3; and 7.0), broodstock spawning (sections 1.10; 2.23; 5.3; 6.2; 6.3; 8.0, and Table 8), rearing and release of juveniles (sections 2.2.3, 9.0 and 10.0), deposition of hatchery adults (sections 1.10 and 7.5), and catastrophic risk management (sections 5.8; 9.2.10; and 10.10). The commenter does not cite any specific sections in the HGMPs or the PEPD pointing to evidence supporting their claims pertaining to plan non-compliance with this criterion.

Protocols addressing fish health, including fish health maintenance and hatchery sanitation procedures applied during broodstock collection, mating, fish incubation, rearing, and release, in compliance with "Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State", are detailed in each of the HGMPs in the aforementioned sections addressing those activities. Fish health monitoring and evaluation measures are also included in the HGMPs. The protocols stand as best management practices for minimizing the risk of harm from fish disease pathogen amplification and transfer. All of the HGMPs describe best management practice protocols for broodstock selection and collection, including objectives, holding and handling practices, and methods. Only non-listed EWS produced through each hatchery program are used as the donor broodstock sources. Broodstock would be collected as the EWS return to the hatchery locations using methods that are sufficiently protective of listed fish populations. Best management practice protocols for broodstock spawning are described in all of the HGMPs. Proposed mating procedures are consistent with NMFS guidelines for hatchery propagation under the ESA (Hard et al. 1992), and as guided by state and tribal agency geneticists to maintain the localized traits, including early return timing, of the propagated populations. Consistent with this Limit 5 criterion, the HGMPs for steelhead provide sufficiently detailed descriptions of proposed spawning practices and effects on listed steelhead and Chinook salmon. Protocols described in the HGMPs for steelhead rearing and release are also consistent with this criterion. Rearing and release practices were developed to ensure the survival and effective release of healthy EWS smolts, while minimizing the duration and magnitude of interactions and effects on listed juvenile fish after the smolts are released. As detailed in the PEPD, the proposed rearing

and release practices, and the HGMP evaluations of ecological interactions between hatchery and natural-origin salmon and steelhead, indicate that the programs would be operated in a manner that adequately conserves listed natural-origin fish. Protocols for the disposition of hatchery-origin adult steelhead collected and spawned are also included in the proposed HGMPs. As described in the PEPD, facility operational and management measures for the programs are specifically designed to minimize the potential for catastrophic events at the hatchery, including the unintentional, early release of EWS juveniles that could lead to unanticipated effects on listed steelhead and salmon.

NMFS also found that the proposed EWS steelhead programs adequately acknowledge the risk of fitness loss potentially resulting from interbreeding between EWS adults that stray from the hatchery release sites and natural-origin steelhead. In section 2.2.2 of each plan, gene flow resulting from EWS natural spawning that may lead to fitness loss in listed natural steelhead populations is extensively accounted for and evaluated. As described in the PEPD, fitness loss risks to natural-origin steelhead populations are controlled by measures that reduce the number of naturally spawning hatchery-origin fish, in general, and in particular those fish that would overlap spatially and temporally with natural-origin spawners. Genetic effect analyses included with the HGMPs, and cited in the body of the plans (Hoffmann 2014; Warheit 2014), indicate that adult EWS produced by the programs that would pose fitness risks have contributed very few fish to the associated naturally spawning populations in the watersheds where the fish are released. Cumulatively, in compliance with this criterion, findings presented in the HGMPs and accompanying analyses (Hoffmann 2014; Warheit 2014) indicate the proposed EWS programs would not pose substantial fitness loss risks through gene flow to listed Dungeness, Nooksack, or Stillaguamish river steelhead populations to the extent that effects would impair the survival or recovery of these populations.

The commenter also alleges that the HGMPs do not include appropriate monitoring, and measures, to detect and avoid fitness loss impacts. This is incorrect. As described in the PEPD, collection of data necessary to derive gene flow rates, and hence fitness loss risks, will be accomplished through a significant, annual sampling effort to obtain thorough and representative tissue samples for DNA analyses from both juvenile and adult wild steelhead in each of the three basins where the EWS programs would operate (Anderson et al. 2014a). The proposed sampling and monitoring effort is wholly appropriate for detecting fitness loss impacts. As stated above, findings presented in the HGMPs and accompanying analyses (Hoffmann 2014; Warheit 2014) indicate the proposed EWS programs would not pose substantial fitness loss risks through gene flow to listed steelhead populations. The programs are proposed for continued operation at smolt release and adult production levels that have been demonstrated to maintain low gene flow levels, and avoid fitness loss impacts to listed steelhead populations.

The commenter alleges that the HGMPs do not address impacts of fisheries targeting hatchery steelhead on wild steelhead. Through its ESA review, NMFS considered whether fisheries impacting steelhead produced by the Dungeness River, Kendall Creek, and Whitehorse Ponds EWS hatchery programs, as described in the HGMPs (Section 3.3 of each HGMP), are interrelated or interdependent actions that are subject to analysis of effects with the EWS HGMPs. Recreational fisheries and tribal commercial and ceremonial and subsistence fisheries for steelhead produced by the proposed hatchery programs incidentally take ESA-listed salmon

and steelhead. These fisheries are managed by WDFW and the tribes, and occur within the Dungeness, Nooksack, and Stillaguamish River watersheds. Outside of these areas, there are no directed fisheries for EWS, and those salmon-directed fisheries would occur regardless of whether the proposed action continues and are therefore not interrelated or interdependent with the proposed EWS hatchery actions. Therefore, only those fisheries for EWS in the Dungeness, Nooksack, and Stillaguamish River basins were considered to be interrelated and interdependent actions. The 2015-16 fisheries were evaluated and authorized through a separate NMFS ESA consultation (NMFS 2015a). They were determined not likely to jeopardize the continued existence of the Puget Sound Steelhead DPS, the Puget Sound Chinook Salmon ESU, or the Hood Canal summer chum salmon ESU or adversely modify designated critical habitat for these listed species (NMFS 2015a). Future fisheries will similarly be subject to ESA review. A new fishery management plan for 2016-17 is currently under development and is expected to be submitted for Section 7 consultation in April 2016. In its biological opinion (NMFS 2016), the past effects of these fisheries are described in the environmental baseline section, and future effects are described in the discussion of effects of the action.

Comment #4 (WFC): The HGMPs do not meet the requirement under Limit 5(i)(H) because there is not adequate monitoring and evaluation of the hatchery programs' success and risks to listed species.

Response: We disagree with the commenters claims, and for the reasons stated in the PEPD, believe that the three EWS HGMPs meet this criterion. Adequate monitoring and evaluation responsive to this criterion is in fact proposed to detect and evaluate the effects of the hatchery programs in meeting each plans objectives, and any risks potentially impairing the recovery of listed steelhead and salmon.

As described in the PEPD, the three HGMPs include monitoring and evaluation (M&E) actions designed to identify the performance of the programs in meeting their fisheries harvest augmentation and listed fish risk minimization objectives. Specific M&E actions for the three HGMPs are described in section 1.10 and section 11.0 of each hatchery plan. Monitoring the harvest benefits of the programs to fisheries from production of returning adult hatchery-origin fish is an important objective (e.g., smolt to adult survival rate and fishery contribution level monitoring). However, all of the EWS programs also include extensive monitoring, evaluation, and adaptive management measures, designed to monitor and reduce risks to listed natural-origin fish populations associated with program implementation.

An adult steelhead monitoring program (spawning ground surveys) would be conducted annually to document abundance and spatial structure of steelhead escaping to natural spawning areas and the hatcheries in the action area basins. In addition, within the Dungeness River system adult genetic samples will be collected opportunistically and analyzed to compare the number of hybrid and hatchery-ancestry fish observed from smolt sampling (Anderson et al. 2014). Within the Nooksack system, genetic sampling of adults will occur as available for the winter-run population, and on a rotating basis every three years for the S.F. Nooksack summer-run population. Within the Stillaguamish system, adult genetic sampling will be conducted in the Deer Creek subbasin on a rotating basis every three years.

Specific M&E actions are also proposed in the HGMPs to evaluate effects on juvenile listed fish. The results of these juvenile fish M&E actions would be used to guide implementation of the proposed EWS programs. Importantly, juvenile salmonid sampling occurring outside of the hatchery locations to monitor the status of natural fish populations and migration behavior of newly released EWS smolts have been previously authorized through separate ESA consultation processes (NMFS 2009; 2015b). Through these previously approved M&E actions, the co-managers propose to continue to monitor interactions between juvenile hatchery- and natural-origin salmonids in freshwater and marine areas within the region to evaluate and manage the EWS programs. Continued juvenile outmigrant trapping by WDFW and Jamestown S'Klallam, Lummi, and Stillaguamish tribes would occur using rotary screw traps and a channel spanning panel weir (Matriotti Creek only) in the Dungeness River and Matriotti Creek, the Nooksack River, and the Stillaguamish River watersheds. These programs would provide important information on the co-occurrence, out-migration timing, relative abundances, and relative sizes of hatchery-origin fish, ESA-listed natural-origin Chinook salmon and steelhead, and non-ESA-listed natural-origin coho, chum, and pink salmon.

Samples to allow M&E of the genetic effects of the proposed EWS programs on listed steelhead populations would be collected using juvenile outmigrant traps. Traps positioned downstream from single or multiple steelhead populations will obtain a mixed sample at trapping sites (Anderson et al. 2014). In cases of multiple populations (e.g., Stillaguamish River trap site), monitoring for introgressive hybridization at the population scale will rely upon genetic stock identification; however, current genetic tools may not permit assignments at this resolution. In these cases, ongoing efforts to improve the Puget Sound genetic baseline by adding more single nucleotide polymorphism samples to the database will improve upon genetic stock identification; if this effort is ineffective, then monitoring for introgressive hybridization will be conducted at the watershed scale rather than at the population scale. WDFW has developed a ten year monitoring plan to sample up to 100 unmarked steelhead annually from the Dungeness, Nooksack, and Stillaguamish smolt traps. Results from the juvenile outmigrant trapping programs described in the HGMPs (Section 11) will be reported as required in the NMFS authorizations for the programs (NMFS 2009; NMFS 2015b).

Comment #5 (WFC): The HGMPs do not meet the requirement under Limit 5(i)(I) because they do not include adequate adaptive management measures, and the absence of adequate and/or assured funding of the essential monitoring activities means that the data necessary to implement any adaptive measures will not be obtained.

Response: We disagree with the commenters' assertion. As described in the PEPD, the proposed HGMPs do in fact provide for evaluating monitoring data, and applying results to adjust supportive breeding actions as needed to improve performance or reduce unanticipated adverse effects on listed fish. The HGMPs provide for regular monitoring and reporting, and responsive adaptive management. As key provisions of the HGMPs, required are implementation of BMPs, monitoring and evaluation of program performance, and adjustment of the hatchery programs accordingly. Each of the three proposed HGMPs identify objectives and actions needed to determine hatchery program performance in meeting stated production

objectives for the specific species that are the focus of each HGMP (HGMP sections 1.10), and effects on non-target natural-origin fish populations in the Dungeness, Nooksack, and Stillaguamish River watersheds. In compliance with this 4(d) Rule criterion, the HGMPs would apply adaptive management and risk management approaches in their implementation of hatchery actions.

Under the HGMPs, annual data collected relating to hatchery program performance and effects would be evaluated by WDFW and the Jamestown S'Klallam, Lummi, Nooksack, Stillaguamish, and Tulalip Tribes to determine whether the three EWS programs were meeting their respective objectives. As identified in Sections 1.10 and 11 of the HGMPs, monitoring and evaluation results would be used to determine whether performance standards addressing program benefits and risks (performance and effects) were met. Contrary to the commenters assertions, the co-managers indicate in the HGMPs that funding and staff resources would be committed to monitor and evaluate the programs through review by the WDFW Fish Program and Jamestown S'Klallam, Lummi, Nooksack, Stillaguamish, and Tulalip tribal technical staffs.

The HGMPs also include as proposed actions reporting of program performance and effects on listed fish to monitor compliance with plan objectives (sections 1.10.2 and 10). The comanagers would report: numbers of hatchery (marked) and natural (unmarked) steelhead returning to the hatcheries, number of broodstock collected, and surplus returns; EWS smolt release information consistent with Equilibrium Broodstock Document requirements (number, location, method and age class); levels of compliance with applicable fish health standards and criteria; effluent discharge water quality and water withdrawal levels compared to permit standards and allowances; and, hatchery smolt migration behavior, and EWS smolt interactions with natural origin fish. In addition to these reporting proposals included in the individual HGMPs, annual levels of gene flow between EWS and natural-origin steelhead populations in the Dungeness, Nooksack, and Stillaguamish river basins would be monitored to gauge whether the programs remain at levels that likely pose unsubstantial risk to the affected wild populations (Anderson et al. 2014). DNA analyses results for juvenile and adult steelhead samples collected in the Nooksack, Stillaguamish, and Dungeness basins would be analyzed and reported to allow for evaluations of whether gene flow limitation objectives of the HGMPs are met, and whether adjustments of the programs are necessary. As stated in the HGMPs, the comanagers propose to continue monitoring, research and reporting of hatchery program performance to assess, and adjust, if necessary, hatchery production and release strategies to minimize genetic and ecological effects on listed natural-origin fish populations. As part of any ESA determination regarding the proposed HGMPs, NMFS would review all reports provided annually for compliance with stated HGMP objectives, and post the reports on the NMFS website for public information purposes.

Comment #6 (WFC): The joint plan (HGMPs) do not meet the ESA "no jeopardy" standard and joint resource management plans submitted under Limit 6 of the 4(d) Rule may be only be approved if the implementation and enforcement of the plan will not appreciably reduce the likelihood of survival and recovery of affected threatened ESUs.

Response: The PEPD provided for public review is not the primary evaluation used by NMFS to make a determination regarding whether the proposed HGMPs jeopardize listed fish. NMFS

completed an ESA section 7 biological opinion as a part of its ESA impact review responsibilities to make a determination whether the plans evaluated in the PEPD would appreciably reduce the likelihood of survival and recovery of ESA-listed Puget Sound Chinook salmon or steelhead. NMFS concluded that its 4(d) determination for the plans was not likely to jeopardize the continued existence of the Puget Sound steelhead DPS and the Puget Sound Chinook Salmon ESU or to destroy or adversely modify designated critical habitat for the DPS and ESU (NMFS 2016). With regards to the Hood Canal summer-run chum salmon ESU, NMFS previously concluded in a separate biological opinion that implementation of the EWS HGMPs, and other salmon hatchery programs in the ESU's geographic boundaries, were also not likely to jeopardize the continued existence of the ESU or to destroy or adversely modify designated critical habitat for the DPS and ESU (NMFS 2002). The NMFS (2016) biological opinion is included as an attachment to NMFS's decision memo presenting the agency's determination regarding whether the three EWS programs meet 4(d) Rule limit 6 criteria and therefore qualify for exception from ESA section 9 take prohibitions.

Comment #7 (Trout Unlimited): The commenter states that the effects analyses in the PEPD are inadequate to provide a basis for informed decision-making under NEPA and for determining compliance with the ESA. This general comment also pertains to the Draft EA that was provided at the same time as the PEPD for public review and comment, and the remainder of the commenter's text pertaining to this specifically addresses the Draft EA and not the PEPD.

Response: The purpose of the PEPD is to evaluate and determine whether activities implemented as described in the three EWS HGMPs proposed for coverage under ESA 4(d) Rule, limit 6 address all of the criteria specified under Limit 5 of the 4(d) Rule that were defined for hatchery programs to be considered sufficiently conservative regarding listed fish effects. After reviewing the HGMPs, NMFS determined that the plans did in fact address each Limit 5 criterion, for the reasons stated in the PEPD. Further, the PEPD provided for public review is not the primary effects analysis document used by NMFS to make a decision regarding whether or not the proposed HGMPs jeopardize listed fish. NMFS completed a section 7 biological opinion as a part of its ESA responsibilities, determining that the plans evaluated in the PEPD would not appreciably reduce the likelihood of survival and recovery of ESA-listed Puget Sound Puget Sound steelhead and Puget Sound Chinook salmon (NMFS 2016). NMFS previously concluded in a separate biological opinion that implementation of the EWS HGMPs was also not likely to jeopardize the continued existence of the Puget Sound Chinook Salmon ESU or to destroy or adversely modify designated critical habitat for the DPS and ESU (NMFS 2002). The completed NMFS (2016) biological opinion is included as an attachment to NMFS's decision memo presenting the agency's determination regarding whether the three EWS hatchery plans meet 4(d) Rule limit 6 criteria and therefore qualify for exception from ESA section 9 take prohibitions.

Comment #8 (Trout Unlimited): The commenter states that precocious EWS hatchery-origin males could be a substantial problem in Puget Sound, and disagreed with the statement in the PEPD that the fish only represent a minimal vector for interbreeding with wild fish. The

commenter also states that precocious males may also provide "tremendous competition for wild male steelhead and trout".

Response: In its assessments of genetics risks posed by the EWS programs, NMFS concludes, based on DNA analysis results that interbreeding and gene flow between EWS and natural steelhead populations - including contribution from adult EWS and any precocious males - is negligible to very low. As acknowledged in the Puget Sound Hatchery DEIS (NMFS 2014), residualism rates for EWS smolts released the proposed programs are not known. Neither are the relative abundances of anadromous and non-anadromous O. *mykiss* in most Puget Sound streams (Myers et al. 2015). McMillan et al. (2007) noted adult and precocious male steelhead participating in mating in the later part of the spawning season in an Olympic Peninsula stream. However, residual males accounted for less than 1% of the observed mating attempts, and only late in the season. Measurable reproductive success of non-anadromous male O. *mykiss* was noted in another Olympic Peninsula stream that has no hatchery program (Seamons et al. 2004). A recent meta-analysis of steelhead programs cited by the commenter found an average residualism rate of 5.6%, ranging from 0% to 17% (Hausch and Melnychuk 2012). For genetic risk assessment purposes, genetically, residual males are of no concern unless they are sexually mature. Although historically high rates of precocious maturation have been reported (e.g., Schmidt and House 1979) and groups can be generated with rates as high as 100% (e.g., Sharpe et al. 2010), the rate in WDFW steelhead releases tends to vary from 1% to 5% (Tipping et al. 2003). For these reasons, NMFS considers potential gene flow risks resulting from interbreeding by natural steelhead with any precocious EWS males to be unsubstantial, and not rising to a level of concern regarding genetic diversity effects on listed steelhead.

The HGMPs proposed for ESA authorization include best management practice-based measures to reduce the likelihood that non-migrating hatchery steelhead that may result in precocious males would result at substantial levels from hatchery program implementation. As stated in the HGMPs, EWS juveniles are released from the hatcheries as fully smolted, seawater ready fish to reduce the likelihood for residualism and associated negative interactions with natural-origin fish. To meet this objective, during rearing and prior to release, the hatchery operators monitor the degree of smoltification within the steelhead populations to help ensure that upon release, the fish are actively migrating smolts. Smoltification traits observed for each rearing population are compared with established steelhead rearing and release protocols to gauge the status of the population for release as smolts. These protocols were developed based on 30 years of staff observations and studies conducted to evaluate residualization risks, including ecological effects on natural fish. The protocols address rearing steelhead population status as smolts, and hatchery-related ecological risk minimization practices:

- Rearing population size uniformity and condition factor: The size uniformity and condition factor of rearing steelhead are monitored through individual fish length and weight sampling and estimation of coefficient of variation (CV) for those parameters. CV and condition factor estimates are compared with estimates shown to reflect readiness of steelhead populations for release as fully smolted fish.
- Individual fish size: EWS release groups must attain an individual fish size of 10 fpp established by Tipping (2001) to indicate the minimum size reflective of fully smolted fish.

- Smolt release timing: Releases of EWS smolts would occur no earlier than May 1st each year to minimize ecological risks for emigrating natural-origin salmon and steelhead juveniles in freshwater.
- Smolt release practices: To the extent feasible, all EWS smolts would be volitionally released from hatchery rearing ponds to minimize residualization risks. As indicated in the HGMPs, WDFW is conducting research on the effects of volitional release practices in the Upper Columbia River region. Preliminary results suggest faster downstream migration for volitionally released smolts, and substantially reduced rates of residualism relative to force-released steelhead (Snow et al. 2013). Volitional releases would begin when steelhead display cues of outward physical signs and behaviors reflecting a state of active smoltification, including loss of parr marks, banding of the caudal fin, and increased attraction of the population to pond edges, inflow, and outflow areas. When these conditions were observed after May 1st, rearing pond end-screens would be removed to provide the opportunity for migration-ready steelhead smolts ready to exit downstream. Steelhead that do not volitionally migrate out of the rearing vessel would be collected and transported for release into non-anadromous lakes to enhance recreational fisheries.

Implementation of these actions, including culling of non-migrating steelhead from rearing ponds, would substantially reduce the likelihood for creation of residuals that could potentially compete with natural steelhead juveniles and spawn with adult natural steelhead as precocious males. The programs meet 4(d) rule criterion that genetic and ecological risks to listed steelhead are accounted for and adequately minimized.

Comment #9 (Trout Unlimited): The commenter disagrees that volitional smolt release practices that would be implemented through the EWS programs reduce the potential for the smolts to residualize and thereby produce precocious parr (Proposed Determination, Pg. 50).

Response: As noted in the response to comment #8, the HGMPs describe practices that would be implemented to promote release of actively migrating seawater ready smolts from the hatcheries that would have a low tendency to not emigrate seaward (residualize), consequently promoting the incidence of precocious males. Among these actions are volitional release of EWS smolts to promote production of downstream migrating, sweater ready smolts. The plans provide sufficient information, some of which is based on 30 years of hatchery program implementation and monitoring, supporting the efficacy of those actions for meeting actively migrating smolt release objectives. Again, as stated in the HGMPs, preliminary results from WDFW studies in the Upper Columbia River region suggest volitionally released smolts exhibit more rapid downstream migration than forced release fish, and substantially lower rates of residualism (Snow et al. 2013). Snow et al. (2013) reported that steelhead smolts released volitionally resulted in one stream-resident fish recaptured for every 7.8 adults returned, while forced releases produced one stream-resident fish recaptured for every 0.48 adults returned. These results indicate that the volitional release and non-migrating fish culling strategy significantly reduces the abundance of residual steelhead, thereby reducing risks of associated negative ecological and genetic interactions between hatchery and natural steelhead.

The PEPD is not the primary effects evaluation document NMFS assembles to make determinations regarding effects of the EWS programs on listed species, including genetic and ecological effects on listed steelhead perhaps resulting from the creation of residual EWS and precocious males. The section 7 biological opinion assembled by NMFS to evaluate and determine whether the proposed programs pose jeopardy to affected ESA-listed steelhead and salmon populations informs NMFS's 4(d) evaluation and determination by addressing these and other potential effects in depth, including the efficacy of volitional releases and other proposed practices in reducing the incidence of residuals and precocious males. In the biological opinion, NMFS concludes that volitional release and culling strategies can be successfully applied to remove the non-migratory segment of EWS release groups, for the purposes of reducing residualism and associated ecological and genetic risks to natural steelhead.

Included with volitional release practices as rationale for this finding in the biological opinion are slot limit size at release criteria applied by hatchery operators for EWS smolts. Largely derived from studies in the Columbia River basin, the size at release criteria helps ensure that the fish are not released at too small or too large of a size such that the incidence of residuals and precocious males would be promoted. Based on a review of available information, NMFS has recommended a steelhead smolt size at release range of 180 mm to 250 mm TL (NMFS 1999). This size range was based primarily on the work of two IDFG researchers, Cannamela (1992, 1993) and Partridge (1985). The maximum size recommendation was based on reports of higher residualism among steelhead over 240 mm TL and higher predation rates by residual steelhead over 250 mm TL (Jonasson et al. (1996). With regards to minimum size, Rhine (1997) reported that smaller steelhead had a significantly greater tendency to residualize than larger smolts. Of steelhead smolts carrying PIT tags, 52.1% of fish released from hatcheries at sizes ranging from 163 to 211 mm migrated downstream and were detected at downstream dams; 66% of steelhead at sizes from 212-250 mm TL were detected downstream, and 83.3% of steelhead greater than 250 mm TL were detected. Bigelow (1997) reported similar results for PIT tagged steelhead smolts released from Dworshak Hatchery. Over 70% of steelhead under 180 mm TL were not detected at downstream sites, while approximately 85% of smolts over 180 mm TL were detected. This information suggests that release of juvenile steelhead less than 180 mm TL will contribute to residualism, and the ideal release size may be larger than 220 mm TL. Under the proposed EWS programs, the target average smolt size at release for yearling fish produced each year would be 5.0 fish per pound, or 210 mm FL (225 mm TL), with a CV for this average size of 10%. This average size target is encompassed by the individual fish size at release range of 180 mm to 250 mm TL recommended by NMFS to adequately minimize residualization risks, including precocious male production.

More recently, Tartara et al (2016) found that volitional migrants exhibited significant apparent survival advantages over volitional non-migrants (defined as fish that did not exit raceways after screens were dropped, and were forced released). The authors concluded that the practice of volitional release (and culling of non-migrants) was useful for removing both fish that failed to reach a size threshold for smoltification or that matured precociously (Tartara et al (2016). They found that a volitional release strategy was successful at segregating migrants from non-migrants in yearling steelhead release groups, further reducing risks of ecological interactions and genetic introgression caused by precocious male hatchery fish interbreeding with wild females. They also reported that downstream travel times were faster in years when yearling steelhead smolt

study groups were volitionally released than in years when the smolts were force released. These findings support implementation of volitional release practices for the EWS programs for the purposes of meeting listed fish risk reduction and adult EWS production objectives of the HGMPs.

For these reasons, NMFS concludes that volitional release practices proposed for the EWS programs would, consistent with 4(d) rule criteria, positively contribute towards minimizing genetic and ecological effects on natural steelhead populations, including ecological and genetic effects caused by residual fish and precocious males.