Grant County PUD Hatchery Monitoring and Evaluation Implementation Plan for Spring and Summer Chinook in the Wenatchee Basin and Summer Chinook in the Methow Basin 2025

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Contents

1. INTRODUCTION

Grant County PUD has hatchery compensation requirements in the Wenatchee and Methow Basins for the operation of the Priest Rapids Project. Along with mitigation production, Grant PUD is required to monitor and evaluate their programs to determine their effectiveness. The objectives of the monitoring and evaluation (M&E) programs have been developed collaboratively within the Priest Rapids Coordinating Committee Hatchery Subcommittee (HSC). These objectives are detailed in *"Monitoring and Evaluation Plan for PUD Hatchery Programs – 2019 Update"* (M&E Plan) (Hillman et al. 2019). This document is the foundation on which the following M&E Implementation Plan (Implementation Plan) was developed. The purpose of this Implementation Plan is to define the methods associated with each objective in the M&E Plan in 2025.

This Implementation Plan describes the M&E activities associated with Grant PUD's spring and summer Chinook production in the Wenatchee Basin and summer Chinook production in the Methow Basin. Grant PUD is a partner in funding additional hatchery production programs (e.g., sockeye, steelhead, spring Chinook, and summer Chinook in the Okanogan and coho salmon in the upper Columbia), but these are not listed in Table 1 because they are led by other organizations (e.g., ONA, CCT, YN).

Table 1. Grant PUD Hatchery Production Programs and the documents describing the associated M&E activities.

Hatchery Production Program	Document Describing M&E Activities
White River Spring Chinook	• Grant County PUD Hatchery Monitoring and Evaluation Implementation Plan for Spring and Summer Chinook in the Wenatchee Basin and Summer Chinook in the Methow Basin 2025
Nason Creek Spring Chinook	
Wenatchee River Summer Chinook	
Methow River Summer Chinook	• Adult, Aquaculture, and Data and Analyses: Grant County PUD Hatchery Monitoring and Evaluation Implementation Plan for Spring and Summer Chinook in the Wenatchee Basin and Summer Chinook in the Methow Basin 2025 • Juvenile Monitoring: Wells and Methow Hatchery Monitoring Implementation Plan 2025
Methow River Spring Chinook	• Implementation of Comprehensive Monitoring and Evaluation of Wells Hatchery Complex Programs in 2025
Columbia River Fall Chinook (Priest Rapids)	• Grant County Public Utility District Implementation Plan 2024-2025 Priest Rapids Hatchery Monitoring and Evaluation

The work described in this plan has ESA coverage provided by ESA permits 18118, 18120, and 23194. All activities conducted under this Implementation Plan shall adhere to all terms and conditions as specified in the referenced permits. The relevant monitoring and evaluation terms and conditions of the referenced permits are provided in Appendix A. These permits allow for changes to monitoring or research protocols with the caveat that such modifications are approved by NMFS prior to implementing those changes.

This Implementation Plan has been organized into four main components; (1) aquaculture monitoring, (2) juvenile monitoring, (3) adult monitoring, and (4) data, analysis, and reporting. Under each component are study designs elements that will be used to inform the overarching program components. The following flow chart shows the relationship of the components and study designs elements used to address each component. Table 2 describes the elements performed for each species, and the associated objectives for each study design element as referred to in Hillman et al. 2019.

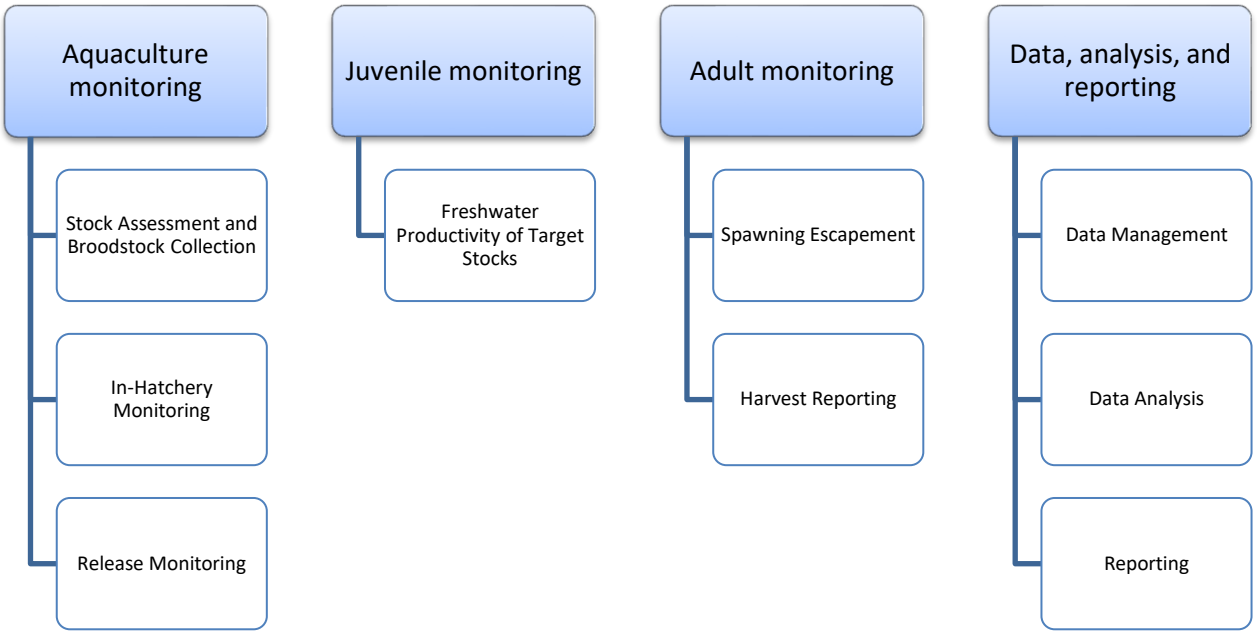
Aquaculture monitoring
Stock Assessment and Broodstock Collection
In-Hatchery Monitoring
Release Monitoring
Juvenile monitoring
Freshwater Productivity of Target Stocks
Adult monitoring
Spawning Escapement
Harvest Reporting
Data, analysis, and reporting
Data Management
Data Analysis
Reporting

Table 2. Study design elements performed for each species, and the associated objectives for each study design element as referred to in Hillman et al. 2019.

Monitoring and evaluation component	Objectives	Study Design Elements	Nason Creek spring Chinook	White River spring Chinook	Wenatchee summer Chinook	Methow summer Chinook
Aquaculture Monitoring	3,5,7,8	Stock assessment and broodstock collection	X		X	X
	5, 8	In-hatchery monitoring	X		X	X
	9	Release monitoring	X		X	X
	9	Post-release monitoring and smolt survival analysis	X		X	X
Juvenile monitoring	2	Freshwater productivity of stocks	X	X	X	X
		Tributary evaluations	X	X		
Adult monitoring	1,2,3,4,5,6, 8,10	Spawning escapement	X	X	X	X
	8	Harvest reporting	X	X	X	X
Data, analysis, and reporting	All	Data management	X	X	X	X
		Data analysis	X	X	X	X
		Reporting	X	X	X	X

2. AQUACULTURE MONITORING

The Aquaculture monitoring component is comprised of two basic elements: (1) stock assessment and broodstock collection at adult trapping locations and (2) in-hatchery monitoring including spawning, rearing, and release of juveniles. Data collected during these elements primarily support monitoring questions 5.1.1, 5.2.1, 8.1.1, 8.2.1, 8.3.1, 8.3.2, 8.4.1, 9.1.1, 9.2.1, 9.3.1 and 9.4.1, but also contribute data to monitoring questions 3.2.1, and 3.2.2 (Hillman et al. 2019) and support the monitoring objectives described in Table 3

Table 3. Monitoring and Evaluation Plan (Hillman et al. 2019) objectives and the associated measured variables for the aquaculture monitoring component.

Objectives	Measured Variables *(Applicable Study Component(s))*
Objective 3: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.	• Number of hatchery and naturally produced fish collected for broodstock (*Broodstock Collection and Stock Assessment*) • Number of broodstock used by brood year (hatchery and naturally produced fish) (*Broodstock Collection and Stock Assessment*)
Objective 5: Determine if the run timing, spawn timing, and spawning distribution of both the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.	• Ages of hatchery and naturally produced fish sampled via PIT tags or stock assessment monitoring (*Broodstock Collection and Stock Assessment*) • Time (Julian date) of ripeness of hatchery and natural origin fish captured for broodstock (*Broodstock Collection and Stock Assessment*)
Objective 8: Determine if hatchery programs have caused changes in phenotypic characteristics of the natural populations.	• Size (length), gender, and total/salt age of broodstock (*Broodstock Collection and Stock Assessment*) • Assess age of fish (*Broodstock Collection and Stock Assessment*) • Length, weight, and age (covariate) of hatchery and natural-origin broodstock after eggs have been removed (*Broodstock Collection and Stock Assessment*) • Number and weight of eggs (*Broodstock Collection and Stock Assessment*)
Objective 9: Determine if hatchery fish were released at the programmed size and number.	• Fork length and weights of random samples of hatchery juveniles at release (*Release Monitoring*) • Monthly individual lengths and weights of random samples of hatchery juveniles (*In-Hatchery Monitoring*) • Numbers of smolts released from the hatchery (*Release Monitoring*)

2.1 Stock Assessment and Broodstock Collection

Broodstock collection and stock assessment for Nason Creek spring Chinook, Wenatchee summer Chinook, and Methow summer Chinook will occur throughout the run to the extent practicable and concurrently and consistent with the annually developed broodstock collection protocols. Trapping locations and timing will be dictated by the annual broodstock collection protocol and the relevant permits. Metrics associated with these activities include migration timing, sex, age, length at age, and origin. Data collected during broodstock collection will be consistent with Hillman et al. 2019. Biological sampling of all fish trapped will include presence of internal (CWT or PIT) and external (VIE) tags or marks, scales, length, and sex. PIT-tags will be injected into all retained fish for broodstock tracking purposes and all released fish to monitor potential fallbacks. Measures of central tendency and spread will be calculated and reported for each metric.

2.2 In-Hatchery Monitoring

The in-hatchery monitoring component will begin when adult fish are collected and retained for broodstock and ends when juvenile fish are released. Life stage specific in-hatchery survival and growth rates, disease monitoring, and an estimated number of fish released will be collected and analyzed according to Hillman et al. 2019. Additional data to be collected includes individual lengths and weights of juveniles during monthly sampling and the weight of gonadal mass and body of spawned broodstock. Measures of the central tendency and spread will be calculated and reported for each metric.

Fish Marking

All Nason Creek spring Chinook, Wenatchee summer Chinook, and Methow summer Chinook hatchery produced fish will be marked for identification by coded wire tag (CWT) and externally identifiable or marked otherwise, as agreed to by the HSC. Additional details are provided in the broodstock collection protocols. The identification of these hatchery produced fish is needed for a suite of adult metrics and may be used for adult management. Table 4 describes the minimum number of PIT-tags that will be implanted into each of the Wenatchee Basin hatchery programs and the Methow River summer Chinook program.

Table 4. The minimum number of PIT-tags to be implanted into Grant PUD's Wenatchee Basin and Methow summer Chinook hatchery programs.

Program	Release goals	Number of fish PIT tagged[1]	PIT tag rate (%)
Nason Creek spring Chinook	125,000 conservation 78,650 safety net	5,000	4.5
Wenatchee River summer Chinook	318,816 (CPUD Program) 206,224 (GPUD Program)	5,000	1.0
Methow River summer Chinook	164,533	5,000	3.0

[1] Additional PIT tagging may take place for Grant PUD and HSC approved studies and/or comparisons.

PIT-tagging will occur at Eastbank Hatchery or acclimation sites (Nason Creek spring Chinook, Wenatchee summer Chinook and Methow summer Chinook) and follow the protocols described in Keller and Murauskas (2012). For all fish marking, quality control check will be performed during and immediately following tagging and prior to release.

2.3 Release Monitoring, Post-Release Monitoring, and Survival Analysis

Hatchery fish will be released during smoltification in the spring, typically between 15 April and 1 June. Whenever possible, the exact release dates will coincide with environmental conditions that promote a rapid emigration that minimizes both the potential negative ecological interactions of hatchery fish with naturally produced fish and predation on hatchery fish by avian or other predators. Below we describe the monitoring data collected for Nason Creek spring Chinook and Wenatchee and Methow summer Chinook.

Pre-release sampling data will be conducted consistent with Hillman et al. 2019, including individual weights to the nearest 0.1 gram. Data collected will support monitoring questions 9.1, 9.2, 9.3 and 9.4 in the Monitoring Plan. PIT-tag monitoring will occur during the release period. The release location and type (i.e., volitional, forced, or trucked) are recorded for each observation file created and uploaded to the PTAGIS database maintained by the Pacific States Marine Fisheries Commission after each year of release. PIT-tagged fish in each observation (release) file are assumed to represent untagged fish. Observation files will contain the PIT tags associated with the original tag files and will be used for analysis. The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release. Fish will also be assessed using indices of precocity/residualism as described in section 10 permits.

Post-Release Monitoring and Survival Analysis

Data will be collected during rearing, acclimation, release, and the emigration period that may prove valuable in explaining variability in adult survival (Hillman et al. 2019). Rearing densities have been reported to influence the survival of hatchery fish (Martin and Wertheimer 1989; Banks 1994) and may also be linked to disease prevalence during rearing (Banks 1994; Ogut and Reno 2004). Acclimation of hatchery fish before release has been found to increase survival and reduce stray rates when the duration of the acclimation period is sufficient (Clarke et al. 2010, 2012; Rosenberger et al. 2013). We will monitor these metrics (i.e., rearing density and acclimation period) annually to determine their influence on adult survival.

Additionally, PIT-tag groups of hatchery fish can be used to estimate survival during their emigration. Variation in survival during the emigration period may also inform observed adult survival rates. Survival during emigration or smolt-to-smolt survival and travel will be estimated using interrogation or release files and the standard Cormack-Jolly-Seber (CJS) estimator. CJS estimates are termed apparent survival estimates because it is unknown whether fish suffered mortality (e.g., size or time of release) or simply failed to emigrate (i.e., residualized or were precocial males). In the latter case, variation in smolt-to-smolt survival rates may be explained by the proportion of PIT-tagged fish detected in the Wenatchee or Columbia rivers after the emigration period is complete. Rates of residualisim (or precocity) will be estimated by monitoring post-migration detections in the Wenatchee Basin and adult ladders in the mainstem Columbia and at Tumwater Dam. We will estimate and monitor the post-release performance of PIT-tag groups annually consistent with methods in Hillman et al. 2019.

3. JUVENILE MONITORING

The juvenile monitoring component is guided by Objective 2 in Hillman et al. (2019) and primarily supports monitoring questions 2.1.1 and 2.2.1 (Table 5):

Table 5. Monitoring and Evaluation Plan (Hillman et al. 2019) objectives and the associated measured variables for the juvenile monitoring component.

Objective	Measured Variables *(Applicable Study Component(s))*
<u>Objective 2:</u> Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.	• Number of juveniles (smolts, parr [where appropriate], and emigrants) (*Freshwater Productivity of Supplemented Stocks*)

3.1 Freshwater Productivity of Supplemented Stocks

Nason Creek Spring Chinook

Nason Creek emigrant abundance will be estimated by operating a rotary screw trap in Nason Creek consistent with historic trapping efforts. Additionally, PIT-tag mark-recapture data will be utilized to test the assumption that emigration during the winter non-trapping periods is negligible. During the late summer or early fall, prior to peak sub-yearling emigration, up to 3,000 Nason Creek parr will be captured and tagged using a systematic spatial distribution approach. Capture, handling, and tagging methods will follow the Integrated Status and Effectiveness Monitoring Program's (ISEMP) protocols (ISEMP 2008). A random sample of a minimum of 10 percent of fish per site will be held in a live box for 24 hours to evaluate tag loss and delayed mortality. Overwinter mortality of PIT-tagged parr is assumed to be the same as non-PIT-tagged parr. Using PIT-tag detections at the lower Nason Creek PIT array during the winter non-trapping period, the total number of juveniles that emigrated will be estimated by expanding the number of detections by the estimated array detection efficiency and by the parr tagging rate, as described here:

Winter Emigration = # of Nason array detections × (1/array detection efficiency) × (1/tagging rate).

The array detection efficiency will be estimated using fish from the PIT-tag mark-recapture trials conducted at the Nason Creek screw trap during the fall (i.e., fish used to develop the flow-efficiency model for the trap will also be used to develop a flow-efficiency model for the array). The tagging rate will be estimated by the recapture rate of PIT-tagged fish at the Nason Creek screw trap (i.e., number of PIT-tagged fish/number of fish). Abundance and variance will be estimated using the same methods as those used in the smolt trap estimate. The estimated abundance and variance from each method and time period (trapping and non-trapping periods) will be summed to estimate a total production estimate. A retrospective analysis of the entire data time series will be performed where applicable to ensure data are comparable over time.

White River Spring Chinook

White River emigrant abundance will be estimated by operating a rotary screw trap or two in the White River consistent with historic trapping efforts. The estimate will not include passage during non-trapping periods and therefore will be viewed as an index rather than a complete emigrant population estimate.

Wenatchee Summer Chinook and Spring Chinook

Juvenile summer and spring Chinook salmon migrants will be monitored at the Lower Wenatchee Trap, consistent with historical trapping efforts. Both sub-yearling and yearling observations will be used to generate an overall juvenile abundance estimate.

Methow Summer Chinook

Juvenile Methow summer Chinook salmon migrants will be monitored at the Lower Methow River smolt trap, consistent with historical monitoring efforts.

4. ADULT MONITORING

The Adult monitoring component is comprised of two basic elements: (1) estimating spawning escapement and (2) harvest monitoring. Data collected during these elements primarily support monitoring questions 1.1.1, 1.2.1, 2.1.1, 2.2.1, 3.2.1, 3.2.2, 4.1.1, 5.1.1, 5.2.1, 5.3.1, 5.3.2, 6.3.1, but also contribute data to monitoring questions 6.1.1, 6.2.1, 8.1.1, 8.2.1, 8.4.1, 10.1.1, 10.1.2, 10.1.3 and 10.1.4 and the monitoring objectives in Table 6 (Hillman et al. 2017).

Table 6. Monitoring and Evaluation Plan (Hillman et al. 2019) objectives and the associated measured variables for the adult monitoring component.

Objective	Measured Variables *(Applicable Study Component(s))*
Objective 1: Determine if conservation programs have increased the number of naturally spawning and naturally produced adults of the target population and if the program has reduced the natural replacement rate (NRR) of the supplemented population.	• Number of hatchery and naturally produced fish on spawning grounds *(Spawning Escapement Estimates)* • Number of hatchery and naturally produced fish taken for broodstock (*Broodstock Collection and Stock Assessment*) • Number of hatchery and naturally produced fish taken in harvest (if recruitment is to the Columbia) *(Harvest Reporting)*
Objective 2: Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.	• Number of hatchery and naturally produced fish on the spawning grounds (*Spawning Escapement Estimates*) • Number of redds *(Spawning Escapement Estimates)*
Objective 3: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.	• Number of hatchery and naturally produced fish on spawning grounds *(Spawning Escapement Estimates)* • Number of hatchery and naturally produced fish harvested *(Harvest Reporting)*
Objective 4: Determine if the proportion of hatchery-origin spawners (pHOS or PNI) is meeting management target.	• Number of hatchery and naturally produced fish on spawning grounds *(Spawning Escapement Estimates)*
Objective 5: Determine if the run timing, spawn timing, and spawning distribution of the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.	• Time (Julian date) of hatchery and naturally produced salmon carcasses detected on spawning grounds within defined reaches *(Spawning Escapement Estimates)* • Time (Julian date) of arrival at mainstem projects and within tributaries (e.g., traps, PIT arrays) with the intent to identify biologically significant differences *(Spawning Escapement Estimates)* • Location (GPS coordinates) of female salmon carcasses observed on spawning grounds *(Spawning Escapement Estimates)*

Objective 6: Determine if stray rate of hatchery fish is below the acceptable levels to maintain genetic variation among stocks.	• Number of hatchery fish collected for broodstock (*Broodstock Collection and Stock Assessment*) • Number of hatchery fish taken in fishery (*Harvest Reporting*) • Locations of live and dead strays (used to tease out overshoot) *(Spawning Escapement Estimates)* • Number of hatchery carcasses (PIT-tagged and/or CWT) found in non-target and target spawning areas or number of returning spawners counted via PIT-tag detection or at weirs in close temporal proximity to spawning areas (stray data into the Entiat subbasin will be obtained from USFWS Fisheries Resource Office-Leavenworth) *(Spawning Escapement Estimates)*
Objective 8: Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.	• Total and salt (ocean) age and gender of hatchery and naturally produced salmon carcasses collected on spawning grounds *(Spawning Escapement Estimates)* • Whenever possible, age at maturity and sex ratio will be measured at weirs or dams near the spawning stream to avoid the size-related carcass recovery bias on spawning grounds (carcass sampling or ultrasound on live fish) *(Spawning Escapement Estimates)* Assess age of fish, including harvested fish *(Spawning Escapement Estimates and Harvest Reporting)*
Objective 10: Determine if appropriate harvest rates have been applied to conservation, safety-net, and segregated harvest programs to meet the HCP/SSSA goal of providing harvest opportunities while also contributing to population management and minimizing risk to natural populations.	• Numbers of hatchery fish taken in harvest *(Harvest Reporting)* Numbers of natural-origin fish taken in harvest *(Harvest Reporting)*

4.1 Spawning Escapement Estimates

Estimates of spawner abundance are required in multiple objectives of the updated monitoring and evaluation plan for the PUD Hatchery Programs (Hillman et al. 2019). Direct enumeration of all spawners is not possible. Hence, a method to estimate spawner abundance is required. The life history strategies of Chinook in the Wenatchee and Methow River basins indicate that the run timing of these populations occur between one to twelve months preceding spawning. For example, peak migration timing of spring and summer Chinook typically occurs in June and July, respectively, while peak spawn timing occurs in August and October, respectively. Because of these differences, enumeration of fish at dams or estimates of abundance using mark-recapture (i.e., PIT tags or other marks) would produce biased estimates of spawner abundance if estimated at locations downstream of the spawning grounds. That is, they may provide "pre-spawn"

escapement estimates, but they do not provide "spawning" escapements, which are needed to calculate productivity and to address monitoring objectives.

Nason Creek and White River Spring Chinook

Spawning escapement will be estimated based on the total number of redds found in each tributary (Murdoch et al. 2010) using methods described in Hillman et al. 2019. Weekly redd and carcass surveys will be conducted simultaneously from the first week of August through September (Appendix B). Redd-based estimates assume that each female constructs one redd, which has been found to be appropriate for this population (Murdoch et al. 2009). The total number of redds in each reach will be estimated using methods described in Millar et al. (2012) and observer efficiency model developed by WDFW. Redd counts will be expanded and the number of hatchery and naturally produced fish will be estimated using methods in Murdoch et al. (2010). Carcasses encountered during surveys will be sampled according to methods outlined in Hillman et al. 2019. All CWTs (i.e. snout or adipose) from carcasses will be sent to the WDFW CWT Lab in Olympia or read locally. The CWT Lab or readers will extract and read CWT and submit all required information to RMIS within one year of collection. In addition, all redds and female carcasses will be geo-referenced using hand-held GPS devices. Carcass recovery bias has been detected in the Wenatchee spring Chinook population (Murdoch et al. 2010) and if not corrected will bias estimates of hatchery and naturally produced fish on the spawning grounds. While it may be appropriate to correct for carcass recovery bias for some monitoring questions (e.g., 2.2), when comparisons to reference populations are made in monitoring questions 1.1.and 1.2, carcass bias will not be corrected because other monitoring programs have not corrected for a similar bias.

Wenatchee Summer Chinook

Wenatchee summer Chinook spawning ground counts will begin the last week in September and continue through the end of spawning in November. Total census redd counts will be conducted by foot or raft depending on stream size, flow, and density of spawners within the stream reach. All stream reaches will be surveyed once per week (Appendix C). Redd data will be collected using methods described in Appendix F, Task 7-2, in Murdoch and Peven (2005) (see Attachment 6 in Appendix 3). Salmon carcass data collected during spawning ground surveys will be consistent with Tasks 7-5, 7-7a, and 7-7b in Appendix F in Murdoch and Peven (2005). All CWTs (i.e., snouts) from carcasses will be sent to the WDFW CWT Lab in Olympia or read locally. The CWT Lab or local readers will extract and read CWT and submit all required information to RMIS within one year of collection. Data collected during spawning ground activities will be managed electronically in the WDFW/PUD database.

Methow Summer Chinook

Adult Methow summer Chinook monitoring will employ the same methods as used in previous years, as described below.

Summer chinook spawning ground surveys in the Methow River will begin in late September and continuing until spawning has ended (usually mid-November). Total census redd counts will be conducted by foot or raft depending on stream size, flow, and density of spawners within the stream reach. (Appendix D). Observers will float or walk through sampling reaches and record the location and numbers of redds each week. Observers will record the following information in field notebooks: date, sampling reach, water temperature, RKm, and a drawing of the habitat units where redds are located. Different symbols will be used for complete, incomplete, and test redds. Each redd will be given a unique number and its location will be recorded on a 7.5-minute topographic map.

To maintain consistency with historical datasets, at least one observer will survey the same stream reach on successive dates. Surveyor's tape may be used in some locations to mark redds and reduce the possibility of recounting older redds. In areas where numerous salmon spawn, surveyors will construct detailed maps of the river and use the cell-area method (Hamilton and Bergersen 1984) to identify the number of redds within each cell. Cells will be bounded by noticeable landmarks along the banks (e.g., bridges or trees) or at stream habitat boundaries (e.g., transitions between pools and riffles). The number of redds in each cell can then be recorded in the corresponding grid on the map. When possible, observers will estimate the number of redds in a large disturbed area by counting females that defend nests. It is assumed that the area or territory defended by a female is one redd and each female produces only one redd.

Salmon carcass data collected during spawning ground surveys will be consistent with Tasks 7-5, 7-7a, and 7-7b in Appendix F in Murdoch and Peven (2005). All CWTs (i.e., snouts) from carcasses will be sent to the WDFW CWT Lab in Olympia or read locally. The CWT readers will extract and read CWT and submit all required information to RMIS within one year of collection. Data collected during spawning ground activities will be managed electronically in the WDFW/PUD database.

4.2 Harvest Reporting – Nason Creek and White River Spring Chinook and Wenatchee and Methow Summer Chinook

In years when the expected hatchery adult returns are in excess of the levels needed to meet the hatchery program goals (i.e., broodstock and/or escapement), surplus fish may be available for harvest. Harvesting or removal of surplus hatchery fish may have benefits to the natural populations by reducing potential negative ecological and genetic impacts (e.g., density dependent effects, loss of fitness, and loss of genetic variation). The contribution of hatchery fish to fisheries will be monitored using CWT recoveries on a brood-year basis supporting Objective 10.

To obtain the necessary data to determine if the harvest rates are meeting objectives, a statistically valid creel program will be designed and implemented for all sport and/or conservation fisheries in the Upper Columbia River to estimate harvest of hatchery fish from both Chelan and Grant County PUD funded hatchery programs (Murdoch and Peven 2005). Information collected during creel surveys are an integral component to calculating the HRR (Objective 3), particularly given most CWT recoveries for PUD mitigation programs occur in the Upper Columbia River and its tributaries, with the exception of summer Chinook where most CWT recoveries occur in ocean fisheries. Because of considerable time lags in reporting of CWT's to the Regional Marking Information System (RMIS) database, it requires an ongoing query of recovery data until the number of estimated fish does not change.

5. DATA MANAGEMENT , ANALYSIS, AND REPORTING

5.1 Data Management

A Microsoft Access database maintained by Washington Department of Fish and Wildlife will contain all the monitoring data collected for hatchery evaluations. The database will contain and manage all data associated with aquaculture monitoring, juvenile monitoring, and adult monitoring. Data will be made available to the HSC upon request.

All data entered into the database are evaluated for quality control and quality assurance. Grant PUD and their contractors will be responsible for data quality control. Quality control checks using analyses such as modified Z-scores, boxplots, and the Generalized Extreme Studentized Deviate Procedure (Iglewicz and Hoaglin 1993) will be conducted for all data entry. In the event outliers are identified, discussion will occur on whether identified outliers are true data points or transcription errors. This process ensures that the data used to test statistical hypotheses are correct and accurate.

5.2 Data Analysis

The analyses proposed are consistent with the Monitoring and Evaluation Plan for PUD Hatchery Programs: 2019 Update (Hillman et al. 2019). Each of the objectives will be addressed using the appropriate statistical tests, as well as graphic analyses that convey relevant information.

5.3 Reporting

An annual M&E report developed by Grant PUD and its contractors will be generated following the completion of each study season. Additionally, monthly progress reports will be made available to the HSC. Year-end draft reports will be made available to the HSC for comments each year. Contractors will be made available to the HSC for presentations and/or discussions at the request of the HSC.

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7. APPENDIX A

Nason Creek Spring Chinook Permit 18118 Research, Monitoring and Evaluation Terms and Conditions:

1. Best management practices for hatchery releases in achieving homing fidelity, precocity, and out-migration criteria will be evaluated annually using CWT and/or PIT tags or other methodology as determined and agreed to by the PRCC HSC. Homing fidelity to Nason Creek and straying to other basins will be monitored using instream PIT tag arrays and CWTs recovered from carcasses. Precocity will be evaluated by examining the proportion of PIT tag releases detected in adult fish ladders within the same year as release. Outmigration performance will be evaluated by monitoring the number of days from release to detection at McNary Dam and the proportion of PIT tags detected within Nason Creek after release.

2. To the extent possible, without imposing increased risk to listed species, the Permit Holders shall enumerate and identify marks and tags on all anadromous species encountered at adult and juvenile trapping sites. This information shall be included in either an annual brood program report or a monitoring and evaluation report submitted to NMFS.

3. In trapping operations directed at the collection of broodstock, the Permit Holders shall apply measures that minimize the risk of harm to listed salmon and steelhead. These measures include, but are not limited to: limitations on the duration (hourly, daily, weekly) of trapping in mainstem river areas to minimize capture and handling effects on listed fish; limits on trap holding duration of listed fish prior to release; application of procedures to allow safe holding, and careful handling and release of listed fish; and allowance for free passage of listed fish, adult and juvenile alike, migrating through trapping sites in mainstem and tributary river locations when those sites are not being actively operated.

4. During implementation of the Nason Creek weir for collection of broodstock, the Permit Holders shall estimate weir rejection and handling (pre-spawn) mortalities, by species

5. Permit Holders or their authorized agents shall determine the number, distribution, and timing of naturally spawning Nason Creek hatchery spring Chinook salmon in the Wenatchee basin.

6. Permit Holders are not required to conduct additional between population stray rate surveys at this time but may use information collected by other parties, subject to a determination that the surveys follow acceptable protocols and that the information is scientifically valid. If current survey efforts change in the future, or if analysis of current data suggest expanded evaluation of stray rates are required in locations such as the Entiat Basin, GPUD will implement additional survey activities as approved by the PRCC HSC.

7. Visual observation protocols must be used instead of intrusive sampling methods whenever possible. This is especially appropriate when merely ascertaining the presence of anadromous fish.

White River Spring Chinook Permit 18120 Monitoring and Evaluation Terms and Conditions:

1. The Permit Holders shall monitor the incidence of, and minimize capture, holding, and handling effects on, listed spring Chinook salmon encountered during trapping as described in the White River Supplementation Program HGMP (GPUD and WDFW 2009). In addition, the Permit Holders shall carefully handle and immediately release upstream incidentally captured listed UCR spring Chinook salmon adults that are not intended for use in broodstock collection, research studies, ongoing stock assessment, or adult management activities.
2. Best management practices for hatchery releases in achieving homing fidelity, residualism, and out-migration criteria will be evaluated annually using CWT and/or PIT tags. Homing fidelity to the White River and straying to other basins will be monitored using instream PIT tag arrays and CWTs recovered from carcasses. Residualism will be evaluated by examining the proportion of PIT tag releases detected in adult fish ladders within the same year as release. Outmigration performance will be evaluated by monitoring the number of days from release to detection at McNary Dam and the proportion of PIT tags detected within White River after release.
3. To the extent possible, without imposing increased risk to listed species, the Permit Holders shall enumerate and identify marks and tags on all anadromous species encountered at adult and juvenile trapping sites. This information shall be included in either an annual brood program report or a monitoring and evaluation report submitted to NMFS.
4. Permit Holders or their agents shall determine the number and the distribution and timing of naturally-spawning White River hatchery spring Chinook salmon in the Wenatchee and Entiat basins. Surveys like this will be required for other areas in the event that new information reveals more than negligible straying. Permit Holders are not required to conduct additional stray rate surveys at this time but may use information collected by other parties, subject to a determination that the surveys follow acceptable protocols and that the information is scientifically valid.
5. Research activities, such as an acoustic tag survival study, will be consistent with those monitoring and evaluation activities identified in the White River PRCC-PC SOA (PRCC 2013).
6. Visual observation protocols must be used instead of intrusive sampling methods whenever possible. This is especially appropriate when merely ascertaining the presence of anadromous fish.

7. The Permit Holders are authorized to biologically sample up to 10 percent of the annual UCR spring Chinook run at TWD or other trapping locations to conduct stock assessment and run composition evaluations, dam passage or other studies.
8. The Permit Holders shall develop, in coordination with the Hatchery Committee, the reporting responsibilities of each of the joint Permit Holders. Final approval of report content, responsibilities, and timelines shall be obtained from NMFS Salmon Recovery Division in Portland, Oregon. The following issues should be considered for required reporting:

Within Hatchery Environment Monitoring Reporting

a. The numbers, pounds, dates, tag/mark information, and locations of fish releases;
b. Standard survival benchmarks within the hatchery environment as defined by the PRCC and PRCC HSC;
c. Monitoring and evaluation activities that occur within the hatchery environment;
d. Coefficient of variation around the average (target) release size immediately prior to their liberation from the acclimation sites as an indicator of population size uniformity and smoltification status;
e. Any problems that may have arisen during conduct of the authorized activities;
f. A statement as to whether or not the activities had any unforeseen effects;
g. Steps that have been and will be taken to coordinate the research or monitoring with that of other researchers;

Natural Environment Monitoring Reporting

h. The efficacy of this hatchery program at benefiting or enhancing the biological status of White River spring Chinook salmon.
i. Annual adult return information shall include estimates of the number and proportion of artificially propagated fish on the spawning grounds, the distribution of hatchery fish on the spawning grounds, and the timing of natural spawning;
j. The number and location of artificially propagated adults that were recovered outside the release areas (e.g., in fisheries or strays to other rivers);
k. Total and index redd counts by tributary basin;
l. Carcass recovery summary that includes sex, origin, tributary location, age, and stock data.
m. Broodstock monitoring and collection summary by location, including summary of all species encountered.
n. Summary of all activities monitoring juvenile UCR spring Chinook salmon in the natural environment including trap locations, tributary or subbasin population estimates;
o. Biological sampling conducted on artificially propagated and natural-origin juveniles in the natural environment;
p. Injuries or mortalities of listed species that result from monitoring activities; and

q. Any other information deemed necessary for assessing the program defined by the PRCC and PRCC HSC.

Terms and Conditions for GPUDs M&E Summer and Fall Chinook Salmon Permit 23194

Monitoring and Evaluation

37. Any activities or methodologies associated with M&E including, but not limited to: PIT tagging, smolt trapping, spawning ground surveys, and redd surveys must be done according to the general guidelines for handling listed fish detailed above.

Reporting

1. If the authorized level of take, including mortalities, is exceeded, the Permit Holders must notify the above contact as soon as possible, but no later than two days after the authorized level of take is exceeded. The Permit Holders must then submit a written report to the above contact describing the circumstances of the unauthorized take within two weeks of take exceedance. Pending review, NMFS may suspend or amend the permit.
2. Permit Holders shall update and provide to the PRCC HSC projected hatchery releases and the specific release locations as well as the broodstock plan for the coming year according to the schedules developed and approved by the PRCC HSC.
3. The Permit Holders shall develop, in coordination with the PRCC HSC, the reporting responsibilities of each of the joint Permit Holders. At minimum, the following issues should be addressed in annual reports submitted to the PRCC HSC:

Hatchery Environment Monitoring Reporting

- Number and composition of broodstock for each program component, and dates of collection
- The numbers, pounds, dates, locations, and tag/mark information of released fish;
- Coefficient of variation around the average (target) release size immediately prior to their liberation from acclimation sites
- The percent of program fish from each release group that are precociously mature (through lethal, gonadal development), or the percent of program fish from each release group that are precociously mature male and parr (based on non-lethal visual observation)
- Survival rates of all life stages
- Disease occurrence
- Any problems that may have arisen during hatchery activities and/or any unforeseen effects on listed fish

Natural Environment Monitoring Reporting

- The number and distribution of returning Priest Rapids, Methow, and Wenatchee programs adults by program component into ESA-listed UCR spring Chinook populations.

The Priest Rapids, Methow, and Wenatchee programs smolt-to-adult survival rate (pre- and post-harvest)

- Post-release out-of-basin migration timing of juvenile program fish by release group to McNary Dam
- Injuries or mortalities of listed species that result from monitoring and evaluation activities

4. Unless otherwise noted in the specific terms and conditions, reports shall be submitted according to the schedules developed and approved by the PRCC HSC.
5. The Permit Holders must provide NMFS with plans for future projects and/or changes in sampling locations or enhancement/research protocols and obtain concurrence from the PRCC HSC before implementation of such changes.

8. APPENDIX B

DRAFT Designated survey reaches for Wenatchee Basin spring Chinook spawning grounds surveys.

Reach Code	Reach Section	River Mile
Chiwawa River and Tributaries (Rock and Chikamin)		
C7	Buck Cr to Phelps Cr	34.5-33.5
C6	Phelps Cr (Trinity) to Maple Cr Br	33.5-29.6
C5	Maple Cr Br to Atkinson Flats	29.6-26.6
C4	Atkinson Flats to Schaefer Cr	26.6-25.0
C3	Schaefer Cr to Rock Cr Campground	25.0-23.0
R1 - Rock	Mouth to Chiwawa River Road Bridge	0.0-0.5
C2	Rock Cr Campground to Grouse Cr	23.0-12.3
K1 - Chikamin	Mouth to Chiwawa River Road Bridge	0.0.-0.5
C1	Grouse Cr to Mouth	12.3-0.0
Nason Creek		
N4	White Pine Creek to Lower R.R. Bridge	16.1-13.7
N3	Lower R.R. Bridge to Hwy 2 Bridge	13.7-9.1
N2	Hwy 2 Bridge to Kahler Cr	9.1-4.5
N1	Kahler Cr to Mouth	4.5-0.0
White River and Tributaries (Panther and Napeaqua)		
H4	Falls to Grasshopper Meadows	14.3-12.9
T1 - Panther	Boulder field to Mouth	1.5-0.0
H3	Grasshopper Meadows to Napeaqua River	12.9-11.0
Q1 - Napeaqua	Falls to Mouth	1.5-0.0
H2	Napeaqua River to Sears Cr Bridge	11.0-6.4
Little Wenatchee River		
L3	Falls to Lost Cr	9.5-6.7
L2	Lost Cr to Old Fish Weir	6.7-2.1
Upper Wenatchee River		
W10	Lake Wenatchee to Chiwawa River	54.2-48.4
Chiwaukum Creek		
U1	Metal bridge to Mouth	1.0-0.0
Icicle River[1]		
I1	Boulder Field to Mouth	5.6-0.0
Peshastin Creek and Tributaries (Ingalls Creek)		
P3	Negro Cr – Ingalls Creek	10.7-9.0
D1 - Ingalls	Trailhead to mouth	1.0-0.0
P2	Ingalls Creek to Private Bridge	9.0-6.4
P1	Private bridge to Mouth	6.4-0.0

[1]*USFWS and Chelan PUD will work together in an effort to continue the annual monitoring and reporting of historical Icicle Creek Spring Chinook redd and/or population survey data with the understanding that neither party currently has an obligation or requirement to perform these surveys. Thereby the parties reserve the right to discontinue or modify prior survey efforts as funding or staffing availability dictates. In the unlikely case that redd surveys are not conducted, carcass surveys will be conducted in Icicle Creek and used in conjunction with PIT-tag-based estimates of escapement of Nason Hatchery spring Chinook in Icicle Creek.*

9. APPENDIX C

DRAFT Designated survey reaches for Wenatchee Basin summer Chinook spawning grounds surveys. Asterisks denotes reaches where redd observer efficiency be assessed.

Reach Code	Reach Section	River Mile
W10	Lake Wenatchee to Bridge	54.20-53.58
	Bridge to Swamp *	53.58-52.66
	Swamp to Chiwawa River	52.66-48.39
W9	Chiwawa River to Schugart Flats	48.39-47.93
	Schugart Flats to Old Plain Bridge	47.93-46.21
	Old Plain Bridge to RR Bridge	46.21-41.91
	RR Bridge to RR Tunnel	41.91-39.28
	RR Tunnel to Swing Pool *	39.28-36.67
	Swing Pool to Tumwater Br	36.67-35.55
W8	Tumwater Br to Swiftwater Campground *	35.55-33.50
	Swiftwater Campground to Unimproved Campground	33.50-33.08
	Unimproved Campground to Tumwater Dam	33.08-30.91
W7	Tumwater Dam to Penstock Br	30.91-28.66
	Penstock Br to Icicle Road Br *	28.66-26.43
W6	Icicle Road Br to Icicle Mouth	26.43-25.61
	Icicle Mouth to Boat Takeout *	25.61-24.49
	Boat Takeout to Leavenworth Br	24.49-23.90
W5	Leavenworth Br to Irrigation Flume *	23.90-22.77
	Irrigation Flume to Peshastin Br	22.77-20.00
W4	Peshastin Br to Dryden Dam *	20.00-17.76
W3	Dryden Dam to Williams Canyon	17.76-15.54
	Williams Canyon to Upper Cashmere Br	15.54-10.22
	Upper Cashmere Br to Lower Cashmere Br	10.22-9.49
W2	Lower Cashmere Br to Old Monitor Br *	9.49-7.12
	Old Monitor Br to Sleepy Hollow Br	7.12-3.27
W1	Sleepy Hollow Br to River Bend *	3.27-1.73
	River Bend to Siphon	1.73-1.29
	Siphon to Mouth	1.29-0.45
Icicle River		
I1	Hatchery to Mouth	2.8-0.0

10. APPENDIX D

Reach Code	Reach Section	River Mile
M1	Mouth to Methow Bridge	0.0-14.78
M2	Methow Bridge to Carlton Bridge	14.78-27.17
M3	Carlton Bridge to Twisp Bridge	27.17-39.55
M4	Twisp Bridge to MVID	39.55-44.85
M5	MVID to Winthrop Bridge	44.85-49.80
M6	Winthrop Bridge to Hatchery Dam	49.80-51.55