



Aquatics Monitoring and Evaluation Program

2022 Annual Report (Final)

Lewis River Hydroelectric Projects
FERC Project Nos. 935, 2071, 2111 and 2213



Naturally spawning kokanee salmon in Cougar Creek, WA.
Photo by Tyle McClure

PacifiCorp
&
Public Utility District No.1 of Cowlitz County

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TABLE OF CONTENTS

1.0 INTRODUCTION	1
2.0 MONITORING AND EVALUATION OBJECTIVES.....	4
3.0 LITERATURE CITED	27

LIST OF FIGURES

Figure 1.0-1. An overview of key features of the North Fork Lewis River Hydroelectric Project area located in southwest Washington.	2
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LIST OF TABLES

Table 1.0-1. Reintroduction performance standard definitions and benchmark values.	3
Table 2.0-1. Coordination table summarizing the Monitoring and Evaluation Plan objectives in 2020.....	7
Table 2.0-2. Coordination table summarizing the Hatchery and Supplementation Plan objectives in 2020.....	20

LIST OF APPENDICES

Appendix A	Lewis River 2022 Fish Passage Program Annual Report
Appendix B	Lewis River Bull Trout 2022 Annual Operations Report
Appendix C	Lewis River Bull Trout 2023 Annual Operations Plan
Appendix D	Yale Reservoir Kokanee 2022 Escapement Report

1.0 INTRODUCTION

The purpose of this report is to document the results the Aquatics Monitoring and Evaluation Program associated with the Lewis River Hydroelectric Project (Project) in 2022. The Project begins approximately 10 miles east of Woodland, Washington (Figure 1.0-1), and consists of four impoundments. The sequence of the four Lewis River impoundments upstream of the confluence of the Lewis and Columbia rivers is: Merwin, Yale, Swift No. 2, and Swift No.1. These four impoundments are licensed separately by the Federal Energy Regulatory Commission (FERC). Merwin (FERC No. 935), Yale (FERC No. 2071), and Swift No. 1 (FERC No. 2111) are owned and operated by PacifiCorp. Swift No. 2 (FERC No. 2213) is owned by Public Utility District No. 1 of Cowlitz County (Cowlitz PUD) and is operated by PacifiCorp in coordination with the other projects. Combined, the Lewis River Project has a generation capacity of 606 megawatts.

On June 26, 2008, the FERC issued Orders approving the Settlement Agreement (SA) and granting new Licenses for PacifiCorp and Cowlitz PUD (Utilities) for operating the Project (PacifiCorp and Cowlitz PUD 2004). Among the conditions contained the SA was that the Utilities were to develop a master monitoring and evaluation plan (the M&E Plan) to implement the terms of Section 9 of the SA. The primary focus of the M&E Plan was to monitor and evaluate the effectiveness of aquatic Protection, Mitigation and Enhancement (PM&E) Measures, and to assess achievement of the Reintroduction Outcome Goals. Anadromous fish reintroduction goals were established in the SA for spring Chinook (*Oncorhynchus tshawytscha*) and coho (*O. kisutch*) salmon, and steelhead (*O. mykiss*) for the portion of the Lewis River located upstream of Merwin Dam. The overarching outcome goal for reintroduction identified in the SA is to:

“... achieve genetically viable, self-sustaining, naturally reproducing, harvestable populations of anadromous fishes above Merwin Dam greater than minimum viable populations.”

The intent of the M&E Plan was also to provide the methods to monitor and evaluate adult fish spawning escapement, fish passage facility hydraulic performance, flow and ramping rates, resident and anadromous fish interactions, and bull trout and kokanee populations.

The M&E Plan was to be developed in consultation with the Lewis River Aquatics Coordination Committee (ACC), and was to address the tasks, methods, frequency, and duration of those tasks necessary to accomplish the monitoring and evaluation items outlined in the SA (Sections 9.2 through 9.8). Performance standards defined in Section 4 of the SA provide the benchmark for the various M&E Plan items (Table 1.0–1). The original M&E Plan was finalized and approved by the ACC in June 2010 (PacifiCorp and Cowlitz PUD 2010). According to the SA, the Utilities shall Consult with the ACC as necessary, but no less often than every five years, to determine if modifications to the M&E Plan are warranted. The first revision of this plan was completed in 2017, and was fully implemented that year (PacifiCorp and Cowlitz PUD 2017).). In April 2022, the second revision of the M&E Plan was completed, and was fully implemented that year (PacifiCorp and Cowlitz PUD 2022). This version serves as the current M&E Plan for work conducted in 2022.



Figure 1.0-1. An overview of key features of the North Fork Lewis River Hydroelectric Project area located in southwest Washington.

Table 1.0-1. Reintroduction performance standard definitions and benchmark values.

Performance Standard	Definition¹	Benchmark Value
Adult Trap Efficiency (ATE)	The percentage of adult Chinook, coho, steelhead, bull trout, and sea-run cutthroat that are actively migrating to a location above the trap and that are collected by the trap.	Determined by the ACC to be 98%
Collection Efficiency (CE)	The percentage of juvenile anadromous fish of each of the species designated in Section 4.1.7 ² that is available for collection and that is actually collected.	99.5%
Collection Survival (CS)	The percentage of juvenile anadromous fish of each of the species (designated in Section 4.1.7) collected that leave the Release Ponds alive.	Smolts > 99.5% Fry > 98% Adult Bull Trout > 99.5%
Injury	Visible trauma (including, but not limited to hemorrhaging, open wounds without fungus growth, gill damage, bruising greater than 0.5 cm in diameter, etc.), loss of equilibrium, or greater than 20% descaling . “Descaling” is defined as the sum of one area on one side of the fish that shows recent scale loss. This does not include areas where scales have regenerated or fungus has grown.	< 2% for smolts
Overall Downstream Survival (ODS)	The percentage of juvenile anadromous fish of each of the species designated in Section 4.1.7 that enter the reservoirs from natal streams and survive to enter the Lewis River below Merwin Dam by collection, transport and release via the juvenile fish passage system, passage via turbines, or some combination thereof (calculated as provided in Schedule 4.1.4. of the Settlement Agreement).	Interim > 80% > 75% after installation of Yale Downstream Collector
Upstream Passage Survival (UPS)	Percentage of adult fish of each species (designated in Section 4.1.7) that are collected that survive the upstream trapping-and-transport process. For sea-run cutthroat and bull trout, “adult” means fish greater than 13 inches in length.	> 99.5%
Active Tag	Tag type that detects and tracks movement of fish (e.g. radio tag, hydroacoustics tag)	N/A

¹ Definitions are taken from Settlement Agreement for the Lewis River Hydropower Projects (PacifiCorp and Cowlitz PUD 2004)

² Species designated in Section 4.1.7 of the Settlement Agreement are spring Chinook, winter steelhead, coho, bull trout and sea-run cutthroat trout.

2.0 Monitoring and Evaluation Objectives

The tasks, methods, frequency and duration of sampling, assumptions, and reporting requirements are outlined for twenty-two objectives in the M&E Plan. The objectives are as follows:

- Objective 1 Quantify overall juvenile fish downstream survival (ODS)
- Objective 2 Quantify FSC collection efficiency
- Objective 3 Quantify the percentage of juvenile fish available for collection that are not captured by the FSC and that enter the powerhouse intakes
- Objective 4 Quantify juvenile and adult collection survival
- Objective 5 Quantify juvenile injury and mortality rates during collection at the FSC (includes injury and mortality of adult bull trout, adult sea-run cutthroat, and steelhead kelts)
- Objective 6 Quantify the abundance and migration timing, by species, of juvenile and adult fish collected at the FSC
- Objective 7 Estimate the migration timing and number of juveniles entering Swift Reservoir
- Objective 8 Develop index of juvenile migration timing
- Objective 9 Quantify adult upstream passage survival
- Objective 10 Quantify adult trap efficiency at each upstream fish transport facility (emphasizes analysis of the Merwin Adult Trapping Facility until upstream passage is expended to Yale and Swift))
- Objective 11 Quantify the number, by species, of adult fish collected at the projects (emphasizes analysis of the Merwin Dam until upstream passage is expended to Yale and Swift)
- Objective 12 Develop estimates of ocean recruits
- Objective 13 Develop performance measures for index stocks
- Objective 14 Document upstream and downstream passage facility compliance with hydraulic design criteria
- Objective 15 Determine spawn timing, distribution and abundance of transported anadromous adults

- Objective 16 Evaluate lower Lewis River wild fall Chinook and chum populations (*Note: This objective, because it is a lower Lewis River monitoring activity, has been moved to become monitoring Objective 1 of the Hatchery and Supplementation Plan – see M&E Plan Objective 21 below.*)
- Objective 17 Monitor bull trout populations
- Objective 18 Determine interactions between reintroduced anadromous salmonids and resident fish (Upstream of Merwin Dam)
- Objective 19 Document Project compliance with flow, ramping rate and flow plateau requirements
- Objective 20 Determine when reintroduction outcome goals are achieved
- Objective 21 Develop a Hatchery and Supplementation Plan (H&S) to support and protect Lewis River native anadromous fish populations and provide harvest opportunity
- Objective 22 Develop a Coordination Table that cross-references Objectives of the Hatchery and Supplementation Plan and the Monitoring and Evaluation Plan

All annual reporting for M&E Plan objectives is contained in this report. However, the National Marine Fisheries Service (NMFS) has designated anadromous fish populations for the North Fork Lewis basin that include naturally produced fish from the entire North Fork Lewis basin (i.e., both upstream and downstream of the Project). Therefore, evaluation of the anadromous fish reintroduction program, as measured by population status, requires that data collected from the monitoring efforts outlined in the M&E Plan be combined with those in the Lewis River Hatchery and Supplementation (H&S) Plan (PacifiCorp Energy and Cowlitz PUD 2020). The development of the H&S Plan monitoring objectives are summarized in the M&E Plan as part of Objective 21. The results of the H&S Plan are reported annually in the H&S Program Annual Operations Report, which is a standalone document for reporting.

The Lewis River Fish Passage Program Annual Report documents the results of various monitoring objectives related to evaluating the anadromous fish reintroduction program and outcome goals. Included in this report are Objectives 1 – 15, and 18 – 20. The 2022 annual report can be found in Appendix A of this report.

Monitoring of bull trout (*Salvelinus confluentus*) populations affected by the Project is stipulated in Objective 17 of the M&E Plan. The goals of this monitoring program are to: 1) inform management decisions; and 2) provide information to assist in gauging whether recovery goals and objectives for bull trout are being met. The Lewis River Bull Trout Annual Operating Plan identifies the specific monitoring actions that will be implemented by the utilities each year to achieve the monitoring objectives. Each year the plan is developed in consultation with the United States Fish and Wildlife Service (USFWS) and the Lewis River Bull Trout Recovery Team (LRBTRT). The Lewis River Bull Trout 2022 Annual

Operations Report can be found in Appendix B of this report. The Lewis River Bull Trout 2023 Annual Operation Plan is provided as Appendix C.

Since 1979, PacifiCorp biologists, along with various state and federal agencies, have conducted annual surveys to estimate spawning escapement of kokanee in Cougar Creek, a tributary to Yale Reservoir. This annual monitoring effort, which is stipulated in Section 9.7 of the SA, continued in 2022. The Yale Reservoir Kokanee 2022 Escapement Report is provided as Appendix D.

Table 2.0-1 below summarizes each of the M&E Plan objectives, any performance goal stipulation, current methods for assessment, and results for the 2022 monitoring period. Table 2.0-1 also includes a reference for each objective on where the reporting can be found in more detail, and whether the objective is related to monitoring work being completed through the H&S Plan. A similar reference is provide for each objective associated in the current H&S Plan (PacifiCorp and Cowlitz PUD 2020) in Table 2.0-2.

Table 2.0-1. Coordination table summarizing the Monitoring and Evaluation Plan objectives in 2022.

Objective No. / Task No.	Objective Description	Performance Goal	Method	2022 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 1	Estimate Overall Downstream Survival (ODS) for anadromous fish species above Swift No. 1 Dam	Juvenile ODS ≥80.0%	ODS is currently measured from the head of Swift Reservoir to the exit of the Release Ponds located downstream of Merwin Dam for coho, spring Chinook, steelhead and sea-run cutthroat trout using PIT tag mark-recapture methods. Survival probability through the reservoir and to capture at the FSC (S ₁), collection survival (S _{COL}), and transport survival (S _{TRAN}) were multiplied and used to estimate ODS for each species.	No estimates of ODS were made in 2022. Feasibility Study (Year One): <u>PIT TAGS RELEASED</u> Swift FSC (Non-Naïve) Coho = 1,331 Steelhead = 200 Eagle Cliff (Naïve) Coho = 1,481 Steelhead = 216 Final Report anticipated by 2024	A two-year feasibility study was initiated in 2022 per the M&E Plan. The primary goal of this study is to evaluate whether there is a difference in recapture probability between naïve and non-naïve release groups by age/size classes. Information from this study will be used to develop methodologies for estimating the number of juveniles entering Swift Reservoir as well as aid in estimating Overall Downstream Survival (ODS). As part of the 2022 effort, juvenile Coho and Steelhead of similar size were captured at the Swift FSC and Eagle Cliff Screw Trap, PIT tagged, and released about 1 mile upstream of Swift Reservoir. A portion of these fish were recaptured in 2022 at the Swift FSC. Additional releases and further detection of these fish as they pass through the system will continue into 2023.	Annual Fish Passage Program 2022 Annual Report	Not Related
M&E - 2	Estimate Swift Floating Surface Collector (FSC) Collection Efficiency (Pce)	Juvenile Pce ≥95.0%	Collection efficiency (Pce) at the FSC is currently measured using fish tagged with biotelemetry tags (radio or acoustic) and released at the head of Swift Reservoir. Tagged fish that subsequently enter the Zone of Influence (ZOI) near the entrance of the FSC are considered available for collection. The proportion of those fish that are subsequently captured in the FSC is Pce.	<u>Estimated 2021 Pce:</u> Coho = 62% ±6% Steelhead = 48% ±7%	In 2022, Pce was evaluated with acoustically tagged Coho and steelhead out-migrants. No Chinook were tagged in 2022 due to low fish numbers. A total of 408 fish were tagged and release as part of this effort. The 95% performance standard was not met for any species in 2022. Overall estimates of Pce for Coho were among the highest reported since the Swift FSC was commissioned and on average with previous years for juvenile Steelhead. Modifications made to the lower portion of the fish collection channel appeared	Annual Fish Passage Program 2022 Annual Report	Not Related

Objective No. / Task No.	Objective Description	Performance Goal	Method	2022 Data	Summary	Results Source Reference	Relation between M&E and H&S
					improve fish retention between the 2021 and 2022 studies. The 2022 study also confirmed that fish were still rejecting the upper portion of the collection channel at a high rate. PacifiCorp plans to make additional adjustments to the entrance of the FSC during summer of 2023 and plans to retest collection efficiency through an acoustic tag study in the spring of 2024.		
M&E - 3	Quantify the percentage of juvenile fish available for collection that are not captured by the Swift FSC and that enter the powerhouse intakes	Monitoring	Not be quantified until downstream collection facilities are installed at Yale and Merwin Dams. Once these facilities are operational, the M&E Plan will be updated to include study protocols to determine turbine entrainment and loss.	Not required to be monitored in 2022	Assessing the proportion of fish entering the intake of the Swift No.1 Powerhouse is required under Section 9.2.1(f) of the SA and identified as Objective 3 of the M&E Plan. However, this M&E Objective will not be quantified until downstream passage facilities are installed at Yale and Merwin Dams.	Annual Fish Passage Program 2022 Annual Report	Not Related
M&E - 5	Determine Collection Injury Rate at the Swift FSC (P_{CINJ}) for juvenile salmonids and adult bull trout and steelhead kelts	Injury rate $\leq 2.0\%$ for all fish examined	Injury rates are determined by daily examination of sampled fish captured in the Swift FSC.	<u>Estimated 2022 S_{CINJ}:</u> Coho (Fry) = $0.0\% \pm 0.0\%$ Chinook (Fry) = $0.0\% \pm 0.0\%$ Steelhead (Fry) = $0.0\% \pm 0.0\%$ Cutthroat (Fry) = $0.0\% \pm 0.0\%$ COMBINED Fry: $0.0\% \pm 0.0\%$ Coho (Smolt) = $1.1\% \pm 0.1\%$ Chinook (Smolt) = $3.6\% \pm$	Combined annual injury rates for each target species ranged from 0 to 3.6 percent. Overall, combined annual injury rates did meet the required performance standard of $\leq 2.0\%$. . Periodic debris accumulation in both the smolt sample tanks during the spring out-migration period was attributed to higher than normal injury rates for spring Chinook in early 2022.	Annual Fish Passage Program 2022 Annual Report	Not Related

Objective No. / Task No.	Objective Description	Performance Goal	Method	2022 Data	Summary	Results Source Reference	Relation between M&E and H&S
				0.8% Steelhead (Smolt)= 3.3% ± 0.6% Cutthroat (Smolt)= 0.0% ± 0.0% COMBINED Smolt = 1.3%±0.1% Steelhead (Adult/Kelts) = 0.0% ± 0.0% Bull Trout = 0.0% ± 0.0%			
M&E - 6	Calculate juvenile and adult collection numbers using Swift FSC subsampling	Monitoring	The total number of fish collected is determined through directing fish into subsampling tanks for physical enumeration. Subsampling rate is based on the amount of time fish are directed into subsampling tanks by automated gates and expanded based on the total amount of time the FSC is operated within a discrete time interval	<u>Estimated Total Juvenile:</u> Coho = 64,964 (juv), 321 (adult) Chinook = 2,534 (juv), 0 (adult) Steelhead = 5,526 (juv), 27 (kelt), 43 (fall back adult) Cutthroat = 2 (fry), 755 (<13"), 119 (>13") Bull Trout = 16	A total of 78,373 (95% CI range: 63,972 – 92,774) salmonids were captured by the Swift FSC in 2022. Of these fish, approximately 72,684 were transported and released downstream of Merwin Dam. Subsampling occurred from May 17 through July 16 to due to large daily collection totals.. During the rest of the season, all daily count was counted by census (i.e., no subsampling).	Annual Fish Passage Program 2022 Annual Report	H&S Objectives 6A, 6B, and 6C
M&E - 7 Task 7.1	Estimate the timing and number of juvenile salmonids entering Swift Reservoir from the Upper North Fork Lewis River subbasin	Monitoring	Operate screw trap located at the head of Swift Reservoir from approximately March 25 through August 15, 2022, to estimate number of out-migrates entering the reservoir by estimating trap efficiency using mark-recapture. Because unsampled periods and reservoir tributaries are not accounted for in this analysis, this information serves as an annual	<u>Mean Bootstrap total estimates:</u> Coho = 130,478 (peak in May) Chinook = 6,341 (peak in mid-June) Rainbow/Steelhead = 5,138 (variable, fry peak in early-July) Cutthroat = 1,067 (variable) Bull Trout = 548 (variable)	The screw trap was operated continuously at Eagle Cliff from March 25 to August 15, 2022 and checked daily. 4336 naturally produced salmonids were captured in 2022. Approximately 76% of Coho, and 91% of Chinook were less than 80 mm FL; 55% of rainbow trout/steelhead were < 150 mm FL. Data suggest that during the 2022 monitoring period, most juvenile Coho (age 1 and 2+) passed the trap in May, while most subyearling Coho (age 0+) passed the trap in	Annual Fish Passage Program 2022 Annual Report	Not Related

Objective No. / Task No.	Objective Description	Performance Goal	Method	2022 Data	Summary	Results Source Reference	Relation between M&E and H&S
			index that could be compared over the same general time period among years.	Trout Fry= 6,431	June and July as did subyearling Chinook. Oy-migrating Steelhead/Rainbow, Cutthroat, and Bull Trout passed the trap mostly in April and May, and fry in July after emergence began.		
M&E - 7 Task 7.2	Estimate the number of juveniles entering Swift Reservoir	Monitoring	Mark-recapture estimate of total juveniles that enter Swift Reservoir relies on PIT tagged fish marked at the Eagle Cliff screw trap (Task 7.1 above) as well as additional fish PIT tagged at the Swift FSC that are released at the head of Swift Reservoir, and subsequently recaptured at the Swift FSC	Feasibility Study (Year One): <u>RELEASED</u> Swift FSC (Non-Naïve) Coho = 1,331 Steelhead = 200 Eagle Cliff (Naïve) Coho = 1,481 Steelhead = 216 <u>RECAPTURED at FSC</u> Swift FSC (Non-Naïve) Coho = 381 Steelhead = 58 Eagle Cliff (Naïve) Coho = 246 Steelhead = 31	A two-year feasibility study was initiated in 2022. The primary goal of this study is to evaluate whether there is a difference in recapture probability between naïve and non-naïve release groups by age/size classes. Information from this study will be used to develop methodologies for estimating the number of juveniles entering Swift Reservoir as well as aid in estimating Overall Downstream Survival (ODS). As part of the 2022 effort, juvenile Coho and Steelhead of similar size were captured at the Swift FSC and Eagle Cliff Screw Trap, PIT tagged, and released about 1 mile upstream of Swift Reservoir. A portion of these fish were recaptured in 2022 at the Swift FSC. Additional releases and further detection of these fish as they pass through the system will continue into 2023.	Annual Fish Passage Program 2022 Annual Report	Not Related
M&E - 8	Develop index of juvenile migration timing	Monitoring	The Lewis River Aquatic Coordination Committee (ACC) determined that, although this	See results of M&E Task 6.1 above	Overall, the run timing in 2022 followed normal frequency distributions both in the spring and again in the fall, with peak	Annual Fish Passage	Not Related

Objective No. / Task No.	Objective Description	Performance Goal	Method	2022 Data	Summary	Results Source Reference	Relation between M&E and H&S
			Objective was specifically called for in the Settlement Agreement, this metric is already covered by M&E Plan Objective 6 and does not need to be duplicated.		migration occurring in late-May and a minor peak in late-November. Approximately 84 percent of all fish collected at the Swift FSC in 2022 were collected between April 15 and July 1, while the remaining 30% were mostly caught in November. The Swift FSC was turned off during the summer months due to high water temperature.	Program 2022 Annual Report	
M&E - 9	Quantify adult upstream passage survival (UPS)	UPS ≥ 99.5%	UPS for adult fish being transported upstream is measured through the direct enumeration of adult fish at the Merwin Fish Capture and Transport Facility (MFCF) and at the adult fish release site above Swift Dam. Any dead fish recovered at trapping or the release sites upstream were identified to species and examined for signs of physical injury, to the extent possible.	<u>Estimated 2021 UPS:</u> Coho (early - S) = 99.7% Coho (late - N) = 100% Spring Chinook = 100% W. Steelhead = 100% Cutthroat = 99.0% COMBINED = 99.9%	UPS for all transported species was high in 2022, with no species having less than 99 percent survival. For the 202 upstream passage season, 14 early (S) coho, and one cutthroat trout mortalities were observed. Nearly all (80%) of the mortality observed in 2022 occurred during the trapping process; very few fish died (n=3) during transport and at release.	Annual Fish Passage Program 2022 Annual Report	Not Related
M&E - 10	Quantify adult trap efficiency (ATE) at each upstream fish transport facility	ATE ≥ 98%	ATE is defined as the percentage of adult fish that are actively migrating that are successfully captured. Mark-recapture of radio tagged adults is used to estimate collection efficiency. Fish that are collected at the trap or at downstream locations are then tagged and released back downstream to continue their upstream migration. A series of monitoring stations are deployed	No evaluation for adult trap efficiency was completed in 2022.	In review of the past five years (2013 – 2019) of evaluation, the ACC determined that reliable operation of the facility's fish lift and conveyance system was the largest contributor to the success of fish being captured at Merwin Dam. In early 2020, PacifiCorp began reviewing possible alternative designs to the current lift and conveyance system, particularly aimed toward modifying the system's crowder that automatically crowds adults from the head of the fish ladder into the lifting hopper.	Annual Fish Passage Program 2022 Annual Report	Not Related

Objective No. / Task No.	Objective Description	Performance Goal	Method	2022 Data	Summary	Results Source Reference	Relation between M&E and H&S
			throughout the tailrace of Merwin Dam and inside the fish trap. These stations are used to characterize fish behavior and quantify passage success.		PacifiCorp had begun the formal process of redesigning the facility's crowding mechanism in December 2020. While it was originally anticipated that a final design would be reached by late-2021 with construction occurring sometime in 2022, delays in the process occurred to the COVID-19 pandemic. It is currently anticipated that construction will now occur sometime during the summer of 2023. Once the redesigned crowder is in place, it is intended that the ATE studies will resume for the target transport species.		
M&E - 11	Quantify the number, by species, of adult fish collected at Merwin Dam (MFCF)	Monitoring	Censuses (direct count). The MFCF is operated and the number of fish recorded daily.	<u>2022 MFCF Count:</u> Coho (early - S) = 21,685 Coho (late - N) = 13,545 Spring Chinook = 4,919 Fall Chinook = 430 Summer Steelhead = 4,377 Winter Steelhead = 2,656 Cutthroat = 102 Sockeye Salmon = 12 Chum Salmon = 3 Pink Salmon = 0 Bull Trout = 0	A total 47,729 adult fish were captured at the MFCF in 2022. Of these, 9,545 adult Coho, 3,600 Spring Chinook, and 594 Winter Steelhead were transported upstream as part of the anadromous fish reintroduitory program.	Annual Fish Passage Program 2022 Annual Report	H&S Objective 3A.1
M&E - 12	Develop estimates of ocean recruits	Threshold Levels for Ocean Recruit Hatchery Produced Adults: Spring Chinook	Methods vary to estimate adult return sizes produced. The purpose behind this objective is largely to inform decisions about the size of the hatchery programing the future as natural production through reintroduction efforts is expected to increase. The ACC	Not completed in 2022	It will take at least five years of analysis before investigators can confidently report ocean recruit numbers and begin evaluating hatchery goals for the Lewis River. Since adult returns of natural-origin fish from the upper Lewis River have not occurred in numbers large enough for meaningful	Annual Fish Passage Program 2022 Annual Report	H&S Objective 3D

Objective No. / Task No.	Objective Description	Performance Goal	Method	2022 Data	Summary	Results Source Reference	Relation between M&E and H&S
		= 12,800 Steelhead = 13,200 Coho = 60,000 Naturally Produced Adult: Spring Chinook = 2,977 Steelhead = 3,070 Coho = 13,953	agreed to change the ocean recruits definition so that jacks are not included or counted as part of the ocean recruits analysis (March 9, 2005 ACC meeting).		analysis, this metric will be postponed until larger natural-origin adult returns are realized.		
M&E - 13	Develop performance measures for index stocks	Monitoring	Performance metrics are to be calculated for reintroduction species upstream of Merwin Dam. These metrics are intended to measure natural production performance, and can include adult and juvenile abundance, and their corresponding ratios for recruit per spawner, smolt to adult, and smolt per spawner. The H&S Plan recommends that other Lower Columbia River stocks be used as index groups to determine whether the success or failure of the Lewis River reintroduction program is the result of in-basin or out-of-basin factors. This would be determined by comparing the survival rates of hatchery and natural-origin fish produced in other basins (such as	Not completed in 2022	In past years (pre-2019) adult returns of natural-origin (NOR) fish from the upper Lewis River had not occurred in numbers large enough for meaningful analysis of metrics related to performance. However since 2019, a coarse calculation of annual performance metrics have been made particularly for returning adult NOR Coho and winter Steelhead to provide some generalize indication of how those stocks are performing. There were not enough returning natural origin spring Chinook from the upper basin in 2022 to perform any coarse level analyses.	Annual Fish Passage Program 2022 Annual Report	Not Related

Objective No. / Task No.	Objective Description	Performance Goal	Method	2022 Data	Summary	Results Source Reference	Relation between M&E and H&S
			the Cowlitz River) with releases made in the Lewis River.				
M&E - 14	Document upstream and downstream passage facility compliance with hydraulic design criteria	Verification	The objective of the hydraulic evaluation was to verify that the performance of the built passage facilities met the performance goals set for the design by NMFS criteria. The hydraulic evaluation for the Swift FSC was completed in 2013; and, for the MFCF, completed in 2014.	Both the Swift FSC and MFCF met the design intent and specified criteria for hydraulic performance.	This task is complete until additional fish passage facilities have been constructed.	2012 Hydraulic Evaluation of Swift Reservoir Fish Screen (Alden and R2 Resources 2013) Hydraulic Evaluation Report - MFCF (MWH 2014)	Not Related
M&E - 15	Determine spawner abundance, timing and distribution of transported anadromous adults	Monitoring	Through discussions within the ATS during the development of this current M&E Plan (2022), it was determined that spawning ground surveys for adult coho and winter steelhead would be postponed until 2026; however upper basin spawner surveys would continue annually for spring Chinook. Ground surveys were also instated for reaches within the reservoir draw down zone to determine the proportion of spring Chinook and Coho spawning in these areas in the fall once water elevation in the reservoir lowered.	<u>2022 Estimates:</u> Total Chinook redd count = 912 (3 in Swift Reservoir Drawdown Zone) Total Coho redd count in Swift Reservoir Drawdown Zone = 51	Chinook estimates suggest that most adult female Chinook transported upstream during 2022 spawned, and timing was consist with prior years (most Chinook spawn in September). Chinook spawning distribution was the largest ever observed, with spawning documented for the first time in the Pine Creek watershed and Rush Creek. A total of 51 coho redds were counted in the Swift Reservoir drawdown zone, which suggests most coho spawned in stream channels upstream of the reservoir drawdown zone. Steelhead redd surveys have been temporarily suspended until 2026 per the current M&E Plan.	Annual Fish Passage Program 2022 Annual Report	H&S Objectives 5A, 5B, and 5.1A
M&E - 16	Evaluate Lower Lewis River wild fall	Monitoring	See H&S Plan (2020) Objective 16	See H&S Plan Annual Report (2022) Objective 16	The ACC made a decision to separate tasks originally identified in the Settlement	Hatchery and Supplementation	H&S Objectives

Objective No. / Task No.	Objective Description	Performance Goal	Method	2022 Data	Summary	Results Source Reference	Relation between M&E and H&S
	Chinook and chum populations				Agreement into monitoring upstream of Merwin dam (M&E Plan Tasks) and monitoring downstream of Merwin dam (H&S Plan Tasks). Because of that distinction, this section, which is a downstream activity, has been transferred to the H&S Plan.	Program 2022 Annual Operations Report	5A, 5B, and 5.1A
M&E - 17	Monitor bull trout populations	Monitoring	2022 monitoring included: Swift Reservoir bull trout survival estimate; redd surveys in Pine, Rush and Cougar creeks, and the mainstem Muddy River; operation of PIT antennas in selected areas; video camera monitoring in Cougar Creek; temperature monitoring of spawning streams; Yale Tailrace bull trout capture and transport upstream; and Swift Bypass Reach capture and PIT tag.	Redd counts in 2022 were comparable to historical trend. Installed temporary tributary PIT antennas operated throughout the spawning period with no interruptions, interrogations of tagged fish remained consistent with historical data collection. The weir and camera in Cougar Creek remained operable throughout the period of deployment, with numerous observations of migrating bull trout.	PacifiCorp and Cowlitz PUD are involved in various bull trout monitoring efforts in Cougar Creek in Yale Reservoir and in the North Fork Lewis River basin upstream of Swift Dam. The 2022 Bull Trout Annual Operations Report provides results for activities that were either ongoing or completed in 2022 as part of this M&E Plan Objective. All monitoring activities are developed annually in consultation with the USFWS and the LRBTRT and are outlined in the Lewis River Bull Trout Annual Operating Plan (2023).	Lewis River Bull Trout 2022 Annual Operations Report	Not Related

Objective No. / Task No.	Objective Description	Performance Goal	Method	2022 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 18	Determine interactions between reintroduced anadromous salmonids and resident fish (upstream of Merwin Dam)	Monitoring	PacifiCorp to monitor the interaction between reintroduced anadromous salmonids and resident fish species. Of specific interest, is the possible effect resident trout released in Swift Reservoir may have on reintroduced salmonids and the effect of anadromous fish introductions on the kokanee populations in Yale Lake. Additionally, concern was expressed that anadromous fish may impact the health and viability of ESA listed bull trout populations. This task is one of the assignments of the Fish Passage Feasibility Study conducted by the US Geological Survey (USGS) and University of Washington (UW), Department of Fisheries. The final report was issued in December 2016 (PacifiCorp 2016).	In 2021, it was identified that some aspects of the 2016 USGS/UW resident/anadromous interaction study should be replicated given the fully operational status of the anadromous reintroduction program upstream of Swift Dam. The Lewis River Bull Trout Recovery Team (LRBTRT) was tasked with developing a Study Plan to assess interactions. Plan implementation in the form of sample collection occurred in 2022.	<p>The LRBTRT identified the lab analysis and Reporting tasks below to be completed in 2023:</p> <p>Provide proportional estimates of predation and consumption of juvenile anadromous salmonids by resident native species across different seasons using stable isotope analysis (SIA);</p> <p>Provide proportional estimates of predation and consumption of juvenile bull trout and resident native species by anadromous salmonids across different seasons using SIA;</p> <p>Provide estimates of potential competition among different resident species and anadromous salmonids for resources using SIA;</p> <p>Provide estimates of predation and competition among species in Pine Creek using SIA; and</p> <p>Provide estimates of predation and competition among species in Rush Creek using SIA.</p>	Annual Fish Passage Program 2022 Annual Report	Not Related
M&E - 19	Document Project compliance with	Monitoring	PacifiCorp agreed to document project flow, ramping rate, flow	Upper release point flow rates in the Bypass Reach	Details on reporting this objective in 2022 are contained the ACC/TCC Annual Report.	ACC/TCC 2022 Annual Report	Not Related

Objective No. / Task No.	Objective Description	Performance Goal	Method	2022 Data	Summary	Results Source Reference	Relation between M&E and H&S
	flow, ramping rate and flow plateau requirements		plateau, and flood storage requirements of the new License for the Project. The monitoring locations for stream flow-requirements are at the USGS Ariel Gage No. 14220500 downstream of Merwin Dam, and two sites in the Lewis River bypass reach below Swift No. 1 Dam. Flood storage requirements are monitored at each of the project dams.	remained above the required minimum flow in 2022. Four Project spill events took place in 2022. The first, occurred in early January at all three Projects, followed by a spill at Merwin in early March, a spill at Swift No. 1 and Yale in mid-June, and a spill at Merwin in early November. No TDG values >110% were reported as a result of spill at Swift and Yale; TDG levels >110% were reported below Merwin however the 7Q10 for natural inflows was met in both cases. Constructed Channel flows remained above the established minimum of 14 cfs year-round; no minimum flow excursions were recorded. Minimum flow below Merwin Dam remained above FERC license minimums; one brief down ramping event was recorded in December.			
M&E - 20	Determine when reintroduction	Yet to be defined as a	Table will be jointly developed by PacifiCorp and the ACC	Not completed in 2022	The Lewis River Settlement Agreement notes: "...the Services, after discussion with the	None	Not Related

Objective No. / Task No.	Objective Description	Performance Goal	Method	2022 Data	Summary	Results Source Reference	Relation between M&E and H&S
	outcome goals are achieved	numeric adult goal that dictates when run-size is sufficient for achieving both recovery and harvest goals. Until the Services develop numeric goals, the natural adult abundance targets presented under M&E Plan Objective 12 (Ocean Recruits) will be used as the benchmarks for determining the success of the reintroduction effort.			ACC, shall determine how they will assess whether Reintroduction Outcome Goals have been met, e.g., metric, model, qualitative factors ("Evaluation Methodology"). The determination shall take into account the variability of the factors influencing the success of the comprehensive aquatics program over time such as cycles of ocean conditions and will include an appropriate temporal component in developing and applying the Evaluation Methodology."		
M&E - 21	Develop a Hatchery and Supplementation Plan	Develop and maintain H&S Plan	The H&S plan is revised and updated on a 5-year cycle . The current plan was updated and submitted to the FERC in December 2020. A major	Results from 2022 are contained in the Utilities 2022 Annual Operations Report (Appendix C). Results from monitoring in	The current version of the H&S Plan (2020) contains nine (9) objectives, and 23 key questions.	Hatchery and Supplementation Program Annual Operations Report	All

Objective No. / Task No.	Objective Description	Performance Goal	Method	2022 Data	Summary	Results Source Reference	Relation between M&E and H&S
			component of the H&S Plan is the creation of an Annual Operating Plan (AOP) that is generated by the Aquatic Technical Subgroup (ATS) and used as the reporting template each year.	2022 are summarized in Table 2.0-2 below.			
M&E - 22	Develop a coordination table that cross references objectives of the H&S and Aquatic M&E Plans	Help support the develop of an annual coordination table using data collected by the M&E and H&S Plans to provide information about Viable Salmonid Population (VSP) metrics such as population abundance and productivity in coordination with WDFW.	Methodology necessary to combine data from both the M&E and H&S plans to develop annual point estimates with precision estimates for these metrics at the population scale has not been developed to date. Combining data to estimate these metrics at the population scale is necessary to fully evaluate the success of PacifiCorp funded reintroduction and hatchery production programs.	Not completed in 2022	The specific detailed methodology for developing metric estimates at the population scale and summary table format will be developed by WDFW and PacifiCorp and will be included as part of annual reporting for Objective 22. The threshold for developing population scale metric summaries will be the same as identified under Objective 12 for developing ocean recruit analysis under Section 2.12.1.2.	Annual Fish Passage Program 2022 Annual Report	All

Table 2.0-2. Coordination table summarizing the Hatchery and Supplementation Plan objectives in 2022.

Obj.	Objective Description	Performance Goal/ Key Questions	Method/Metric	2022 Data	Summary	Results Source, Reference	Relation between M&E and H&S
H&S - 1.0	NOAA accepts final HGMP for each hatchery program	Acceptance by NOAA	NA	NA	HGMP's are anticipated to be submitted in 2023	NA	M&E Objective 21
H&S - 1.1	Biological Opinion is issued for each hatchery program	NOAA issues biological opinion	NA	NA	NA	NA	M&E Objective 21
H&S - 2.0	H&S Plan is submitted and accepted by the FERC	H&S Plan accepted by the FERC	Planning	NA	Submitted in Dec 2020, FERC acceptance March 2022	PacifiCorp Lewis River relicensing website	M&E Objective 21
H&S - 2.1	Finalize an annual operating plan (AOP)	AOP is completed each year	Planning	NA	2022 Annual Plan completed 12/2022	Appendix B, H&S Annual Report	M&E Objective 21
H&S - 2.2	Final annual operations report is submitted and accepted by the FERC	Report is submitted to the FERC on time	Reporting	NA	2022 Annual Report submitted to FERC 6/2022	PacifiCorp Lewis River relicensing website	Settlement Agreement 14.2.6
H&S - 2.3	Final annual hatchery report is submitted by WDFW to the Utilities	PacifiCorp receives annual hatchery report (WDFW hatcheries staff)	Reporting	NA	Report received 4/2022 from WDFW	Appendix G, H&S Annual Report	Not Related
H&S - 3.0	Determine whether hatchery production protocols incorporate best available management practices to support program targets and goals.	A. Do hatchery broodstock collection protocols support program goals?	3A.1: Trap entry timing (Merwin trap)		Brood collection achieved all targets	3A.1: Figure 1-3, H&S Annual Report	M&E Objective 11
			3A.2: Broodstock retention rate		Brood retention rate was similar to trap timing across the return timing; spring Chinook brood were retained at a slightly faster rate than actual trap return timing.	3A.2: Figures 4,5; Table 1, H&S Annual Report	M&E Objective 21
			3B.1: Spawning Matrices and timing		Hatchery protocols were followed for all species	3B.1: Tables 2,3, H&S Annual Report	M&E Objective 21

Obj.	Objective Description	Performance Goal/ Key Questions	Method/Metric	2022 Data	Summary	Results Source, Reference	Relation between M&E and H&S
		support program goals?	3B.2: Broodstock Fecundity		Fecundity was similar to previous years with the exception of late winter steelhead which show lower average fecundity compared to previous years	3B.2: Tables 4,5, H&S Annual Report	M&E Objective 21
			3B.3: Feeding rations and delivery methods	Not evaluated in 2022	NA	3B.3: H&S Annual Report	M&E Objective 21
			3B.4: Avian predation rate	Not evaluated in 2022	NA	3B.4: H&S Annual Report	M&E Objective 21
			3B.5: Volitional releases	See Key Question 4A	NA	3B.5: Table 13, H&S Annual Report	M&E Objective 21
			3B.6: Total Dissolved Gas at Lewis River hatchery	See Appendix C	Appendix C provides results from TDG sampling in 2017 and 2022 at Lewis River hatchery. Elevated TDG levels do not appear to be related to hatchery infrastructure or excess mortality among juveniles rearing at the facility	Appendix C, H&S Annual Report	M&E Objective 21
	C. Are adult collection, handling and disposition (as defined in the AOP) protocols consistent with HSRG recommendations?	3C.1: Size of returning HOR and NOR adults (Merwin Trap)	Not consistently evaluated in 2022	Spring Chinook (avg. length) = female: 734mm; male: 730 mm. Late winter Steelhead: inadequate sample size. Coho: inadequate sample size, or data not readily available.	3C.1: H&S Annual Report	M&E Objective 21	
		3C.2: Age of returning HOR and NOR adults (Merwin Trap)	Age data for coho and late winter steelhead age not currently available, data for Chinook provided by WDFW	Spring Chinook: Age 2 = 2%; age 3 = 10%; age 4 = 77%; age 5 = 11%; age 6 = < 1%. Fall Chinook (brights): age 2 = 5%; age 3 = 13%; age 4 = 46%; age 5 = 36%; age 6 = < 1%.	3C.2: Table 6, H&S Annual Report	M&E Objective 21	

Obj.	Objective Description	Performance Goal/ Key Questions	Method/Metric	2022 Data	Summary	Results Source, Reference	Relation between M&E and H&S
			3C.3: Distribution of adult trap captures		Given the large number of data, please refer to H&S Annual Report where summaries are provided for each transport species distributed to 1) upstream transport, brood, actually spawned, mortalities and nutrient enhancement (if conducted).	3C.3: Tables 7 - 11, H&S Annual Report	M&E Objective 21
			3D: Smolt to Adult Ratio (SAR) of all hatchery releases	Not evaluated in 2022	Methods to evaluate SAR's of hatchery released smolts in currently in development and should be available in the 2023 report	3D: H&S Annual Report	M&E Objective 12
		E. Is the fish health strategy effective at reducing infections and mortalities?	3E.1: Infection rate and prevention	Not yet available for 2022	If received by WDFW these data will be included as part of the 2022 report submittal to the FERC	3E.1: H&S Annual Report	M&E Objective 21
			3E.2: Mortality Rate	Not yet available for 2022	If received by WDFW these data will be included as part of the 2022 report submittal to the FERC	3E.2: H&S Annual Report	M&E Objective 21
		F. Do hatcheries incorporate new scientific advances to improve fish culture effectiveness and efficiency?	3F: Periodic review of hatchery operations relative to current literature	not completed by ATS	Results to be reported after the ATS completes their review	3F: H&S Annual Report	M&E Objective 21
H&S - 4.0	Adopt strategies that limit potential post-release ecological interactions between hatchery and NOR listed species	A. Do current hatchery releases result in spatial and temporal overlap between HOR and NOR juveniles?	4A.1: Release locations of hatchery reared smolts relative to in-river spawning locations.		All releases occurred at planned release locations (i.e., no exceptions occurred)	4A.1: Table 13, H&S Annual Report	M&E Objective 21
			4A.2: Release timing of hatchery reared smolts relative to presence of NOR juveniles or adults. (see 4B)		This objective relates to whether the release timing of hatchery smolts overlap with the presence of NOR juveniles (i.e., ecological interactions). Juvenile screw trapping is used to evaluate this key question.	4A.2: H&S Annual Report	M&E Objective 21

Obj.	Objective Description	Performance Goal/ Key Questions	Method/Metric	2022 Data	Summary	Results Source, Reference	Relation between M&E and H&S
		B. Does the migration rate of HOR juveniles result in overlap with NOR juveniles or spawning adults?	4B: Migration timing and rates of HOR and NOR smolts		This objective relates to whether the release timing of hatchery smolts overlap with the presence of NOR juveniles (i.e., ecological interactions). Juvenile screw trapping is used to evaluate this key question.	4B: Figures 4 and 6, H&S Annual Report	M&E Objective 21
		C. Are the number of hatchery released juveniles equal to or less than production targets?	4C: Number of smolts released by species		This key question relates to whether actual releases match planned releases to manage risks from releasing larger than planned number of smolts from the Lewis River hatcheries.	4C: Table 14, H&S Annual Report	M&E Objective 21
		D. Are the sizes (length and weight) of released hatchery juveniles equal to or less than program targets?	4D: Mean length and weight of smolts released by species and period		Batch weights are used to determine whether fish size is similar to planned release size to manage risks of released larger than planned smolts from the Lewis River hatcheries.	4D: Table 15, H&S Annual Report	M&E Objective 21
		E. What is the precocity rate for hatchery juveniles by release group prior to scheduled releases?	4E: Precocity Rate		Precocity evaluations in 2022 focused on observed precocity rates of spring Chinook rearing at the Lewis River hatchery (release date, October 2022). Mean lengths and weights were also recorded for late winter Steelhead pre and forced release groups.	4E: Table 16 and Table 17, H&S Annual Report	M&E Objective 21
H&S - 5.0	Estimate spawner abundance of late winter Steelhead, Coho, Chum and Chinook downstream of Merwin Dam	A. Are estimates of spawner abundance unbiased and meeting precision targets?	5A: Monitoring assumptions are met		Sampling bias and assumption testing is ongoing for both Chinook and Coho Jolly-Seber spawner estimates	5A: Strategy G of the 2022 AOP	M&E Objectives 15 & 16

Obj.	Objective Description	Performance Goal/ Key Questions	Method/Metric	2022 Data	Summary	Results Source, Reference	Relation between M&E and H&S
		B. Are annual estimates of natural origin spawner abundance increasing, decreasing or stable?	5B: Estimate of total spawners (5 year trend)		Observed 5-year spawner abundance trends: Fall Chinook = stable; spring Chinook = increasing; late winter Steelhead = stable; Coho = increasing	5B: Figures 9, 10; Tables 18, 19, 20 and 21, H&S Annual Report	M&E Objectives 15 & 16
H&S - 5.1	Determine the spatial and temporal distribution of spawning late winter Steelhead, Coho, Chum and Chinook downstream of Merwin Dam	A. Are annual trends in temporal and spatial spawning distribution increasing, decreasing or stable?	5.1A: Redds per mile and reach, redd, carcass and live timing (observed)		Temporal and spatial distribution is stable among all transport species, however, Chinook spatial distribution is not reported as no accurate method has been developed yet to differentiate between Chinook and Coho redds in the mainstem.	5.1A: Table 22, 23, 24; Figures 11, 12, 13, 14, H&S Annual Report	M&E Objectives 15 & 16
H&S - 6.0	Estimate juvenile outmigrant abundance for late winter Steelhead, Coho, and Chinook downstream of Merwin Dam	A. Are estimates of NOR juvenile outmigrant abundance unbiased and meeting precision targets?	6A: Monitoring assumptions are met		Sampling bias and assumption testing is ongoing for juvenile abundance estimates for all species	6A: H&S Annual Report	M&E Objective 6
		B. Is the abundance of NOR juvenile outmigrants by species and outmigration year increasing, decreasing, or stable?	6B: Abundance estimate of total NOR and HOR migrants by species and cohort		Juvenile abundance (5-year observed trend): NOR Coho = Increasing NOR Chinook = Stable, NOR Steelhead = Stable	6B: Table 25, 26; Figure 15, H&S Annual Report	M&E Objective 6

Obj.	Objective Description	Performance Goal/ Key Questions	Method/Metric	2022 Data	Summary	Results Source, Reference	Relation between M&E and H&S
		C. What are the morphological characteristics of outmigrating NOR juveniles relative to their conspecific HOR juveniles?	6C: Phenotypic differences between NOR and HOR juveniles (length, smolt index)	Not evaluated in 2022	Only average fork length comparisons between HOR and NOR Coho and late winter Steelhead are available as no spring Chinook were captured while the screw traps were deployed in 2022.	6C: Table 27, 28, H&S Annual Report	M&E Objective 6
H&S - 7.0	Monitor the extent of genetic risks associated with integrated and segregated hatchery programs on naturally spawning listed populations in the North Fork Lewis River	A. Have the Lewis River hatchery programs impacted the among-population diversity of naturally spawning populations?	7A: F_{ST} , genetic distance combined with dendrograms, multi-variate clustering analyses	Not evaluated in 2022	Finalizing a genetics monitoring strategy had not be finalized by the ATS in 2022. However, an evaluation of existing samples using SNP's is occurring in 2023 and the ATS is anticipated to finalize the overall genetics strategy for all species in 2023.	7A: H&S Annual Report	M&E Objective 21
		B. Have the Lewis River hatchery programs impacted the within-population diversity of naturally spawning populations?	7B: Effective Population Size (N_e), Average F_{IS} , heterozygosity, allele frequency and number	Not evaluated in 2022	NA	7B: H&S Annual Report	M&E Objective 21
		C. Have the Lewis River hatchery programs increased the risk of domestication for naturally spawning populations?	7C: See 8(a)	Not fully evaluated in 2022	NA	7C: H&S Annual Report	M&E Objective 21

Obj.	Objective Description	Performance Goal/ Key Questions	Method/Metric	2022 Data	Summary	Results Source, Reference	Relation between M&E and H&S
		D. Have the Lewis River hatchery programs impacted the phenotypic diversity of naturally spawning populations?	7D: Migration and trap timing(3.A.1), spawn timing (3.B.3), size and age at maturity (3.C.1), size and age of juvenile NOR/HOR outmigrants (6.C), fecundity (3.B.3), precocity (4.E)	Not fully evaluated in 2022	Phenotypic diversity metrics are collected as part of other objectives and key questions contained in the AOP. More specific reporting on this key question will be available once the genetics strategy is fully developed.	7D: Figure 16, H&S Annual Report	M&E Objective 21
H&S - 8.0	Determine the percent hatchery-origin spawners (pHOS), proportionate natural influence (PNI) and pNOB (for integrated programs)	What are the trends in pHOS, PNI, pNOB and PEHC and do they meet HSRG recommendations by program (when applicable)?	8A.1: pHOS - late winter Steelhead	Not evaluated in 2022	The ATS has not developed a strategy for determining pHOS of winter Steelhead that does not rely on invasive tangle netting on the spawning grounds (prior to 2019). This task is a priority in 2023.	8A.1: H&S Annual Report	M&E Objective 21
			8A.2: pHOS - Coho		This estimate relies on sampled carcasses on the spawning grounds in both the mainstem and select tributaries to the mainstem	8A.2: Tables 29, 30, H&S Annual Report	M&E Objective 21
			8A.3: pHOS - Chinook		This estimate relies on sampled carcasses recovered from the spawning grounds in the mainstem	8A.3: Table 31, H&S Annual Report	M&E Objective 21
			8A.4: PNI - late winter Steelhead, late Coho	Data not currently available	No estimate available because pHOS for Steelhead is not yet available; pNOB for Coho has not yet been provided by WDFW	8A.4: H&S Annual Report	M&E Objective 21
			8A.5: pNOB - late winter Steelhead, late Coho	Data not currently available	Late winter Steelhead pNOB = 85%; late Coho - total number of HOR and NOR spawners is available, however, it is unknown the number of HOR and NOR spawners used to meet the H&S targets (i.e., how many of the HOR's were dedicated to egg collection for the Washougal hatchery)	8A.5: H&S Annual Report	M&E Objective 21

3.0 LITERATURE CITED

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APPENDICES

APPENDIX A

LEWIS RIVER FISH PASSAGE PROGRAM – 2022 ANNUAL REPORT

(SAVED AS SEPARATE FILE)

APPENDIX B

LEWIS RIVER BULL TROUT 2022 ANNUAL OPERATIONS REPORT

(SAVED AS SEPARATE FILE)

APPENDIX C

LEWIS RIVER BULL TROUT 2022 ANNUAL OPERATIONS PLAN

(SAVED AS SEPARATE FILE)

APPENDIX D

YALE RESERVOIR KOKANEE 2022 ESCAPEMENT REPORT

(SAVED AS SEPARATE FILE)