APPENDIX C. BASELINE INFORMATION AND DATA FOR QUILCENE NATIONAL FISH HATCHERY, 2014

Dan Magneson
US Fish and Wildlife Service, Quilcene National Fish Hatchery,
281 Fish Hatchery Road, Quilcene, WA 98632

History of fish culture at Quilcene NFH

Quilcene National Fish Hatchery was constructed in 1911 by the U.S. Bureau of Fisheries for $16,700. The hatchery was authorized by Congress on January 29, 1909 "…to establish two or more fish cultural stations on Puget Sound, or its tributaries in the State of Washington, for the propagation of salmon and other food fishes…".

Quilcene NFH is located on Washington's Olympic Peninsula in Jefferson County. The hatchery itself is located at the confluence of Penny Creek and the Big Quilcene River, adjacent to U.S. Highway 101. The hatchery is situated approximately 2 miles south of the town of Quilcene, Washington and approximately 75 miles north of Olympia, Washington. A second station was established on the Duckabush River, with construction begun just slightly later in the year. The Duckabush Fish Hatchery subsequently closed in 1942.

Fish cultural operations at Quilcene NFH began on October 23, 1911 with the spawning of a single female coho salmon. Early fish propagation at Quilcene NFH was predominately comprised of winter steelhead, chum salmon (both summer and fall run), and coho salmon with much more minor and/or intermittent involvement with fall chinook, pink and sockeye salmon.

In the very early 1930s, a trout propagation program was added in order to stock the waters of Olympic and Mount Rainier National Parks as well as the waters of military reservations. The species reared were brook, cutthroat and rainbow trout. In 1963, trout production peaked at approximately two-thirds of the total pounds of fish reared at Quilcene NFH.

Emphasis shifted back to anadromous fish in the late 1970s, and in 1979, a spring Chinook salmon program was initiated. A great deal of effort was expended in the development of a successful program, but due to a history of poor adult returns, it was discontinued in 1993.

Attempts were also made over the years to establish a hatchery-propagated population of fall Chinook salmon at Quilcene NFH, but again, these efforts met with little success and were eventually abandoned.

The fall chum program, formerly undertaken at a satellite facility at Walcott Slough (Brinnon, Washington), was shifted to Quilcene NFH in phases by the late 1980s to avoid potential harvest impacts on Skokomish River winter steelhead (resulting from fisheries targeting fall chum salmon). The fall chum operation at Walcott Slough apparently ended with the 1989 spawning there and became solely a Quilcene NFH program thereafter. However, fall chum salmon were reluctant to ascend the Big Quilcene River all the way to the hatchery, and they were reluctant also to ascend the fish ladder to the hatchery. Also, due to their later return timing, a fishery never fully developed for them.

Hood Canal summer chum salmon, identified genetically and ecologically by NOAA-Fisheries as an *evolutionarily significant unit* (ESU), suffered severe population declines and were proposed for listing under the U.S. Endangered Species Act (ESA) in 1994. Hood Canal summer chum salmon were subsequently listed under the ESA as a *threatened* species, which remains their current status. Quilcene NFH undertook a summer chum program to assist with ESA recovery of these fish beginning with the 1992 adult spawning season. This hatchery program was highly successful, both in (a) restoring summer chum salmon to other Hood Canal streams in which these fish had been extirpated and (b) in boosting the summer chum population within the Big Quilcene River itself.

Final spawning operations for both the summer and fall chum programs concluded with the 2003 season (inclusive). The summer chum program was designed to “sunset” after 15 years in 2007 but was terminated early because it had successfully achieved its goals by 2003.

Today, Quilcene NFH is devoted exclusively to propagating coho salmon. The goals for this program are 400,000 coho smolts at 16.67/lb. for on-station release into the adjacent Big Quilcene River (release approximately May 1st of each year), and 200,000 coho pre-smolts at 22.10/lb. for transfer to the Skokomish Tribal Net Pen Program conducted in Quilcene Bay; this latter transfer typically takes place in mid-March each year. Additionally, 450,000 eyed coho eggs are transferred to the George Adams State Fish Hatchery (Washington Department of Fish and Wildlife) to ultimately provide fish for the saltwater net-pen program of the Port Gamble S’Klallam Tribe.

Adult coho salmon typically return to Quilcene NFH from early August through early November. Current broodstock needs are 750 females, 600 males and 150 jacks (two-year old males), and these fish are taken throughout the entire spectrum of the run. Incorporation of jack coho has been at a 20% level (20% of spawned males are jacks) since 2007 in an effort to maintain gene flow among year classes and the three brood lines as one genetic population.[1] While variable by return year, adult returns are typically well in excess of spawning needs, and these excess adult coho salmon are made available to five Native American tribes on a rotational basis. After tribal interest is fulfilled, fish may then be provided to food banks.

The on-station release of coho smolts cannot occur before April 15th under current comanager agreements due to potential predation and competition impacts on summer chum fry. Moreover, historic tagging data have shown that a target release date of an approximately May 1st delivers better adult coho returns than past, earlier releases in March and April.

The sole exception to a complete focus on coho salmon is the station's Isolation Building which supported a portion of the Hood Canal Steelhead Research Project (Barry Berejikian, NOAA – Fisheries, Manchester Laboratory, Manchester, WA, is project lead) from 2007 to 2014 (inclusive). Hood Canal winter steelhead were listed as a threatened species in 2007. This steelhead program involves final eyed egg incubation and early rearing of winter steelhead originating from the Dewatto and Duckabush Rivers. A portion of eyed eggs are pumped from redds within these rivers and delivered to Quilcene NFH for incubation, hatching and early rearing. The limits imposed on collection of viable embryos are 9,566 and 8,620 eyed eggs from the Dewatto and Duckabush rivers, respectively. The hatched fish are transferred from Quilcene NFH to the hatchery facility of Long Live the Kings (at Lilliwaup, Washington) in middle to late summer for extended rearing. Although project monitoring is slated to continue through 2022, Quilcene NFH's role concluded with completion of rearing and transfer of the 2014 brood year.

Hatchery infrastructure

Major physical features which comprise the Quilcene NFH are:

[1] Hatchery-propagated coho salmon typically return and spawn at three years of age except for a variable proportion of males that return and spawn at two years of age (aka "jacks"). Jacks are considerably smaller than three-year old males and had been excluded historically from the broodstock at Quilcene NFH for many years, thus resulting in three genetically distinct "brood lines" as opposed to one genetic population. Current protocols are designed to reestablish genetic continuity among the three brood lines.

- 2 residences (“Quarters 4 and 7”). Occupied by hatchery employees who live on site.
- 1 Little Cabin. Occupied on an overnight/temporary basis by USFWS employees conducting hatchery business.
- 1 main hatchery building supplied with water from Penny Creek. Building includes: office areas, conference room and a small visitor center; laboratory; attic storage; 27 3x16-ft fiberglass rearing tanks; 12 “green egg” troughs each with a 10-basket capacity; 42 16-drawer vertical Heath-style incubator racks with 630 useable trays.
- 1 Isolation Building with 320 gallons per minute (gpm) well water supply (Well 1). Building includes chilling capacity, 8 half-stack vertical incubators with 56 useable Heath-style trays (each tray can be subdivided into four separate units per tray), 20 oval rearing tanks (6.55 ft^2); a 1500-gallon concrete chemical contact tank for effluent water treatment; back up electric generator, and additional room with a domestic water chlorination/filter system.
- 2 water intake structures on the Big Quilcene River: one with a NOAA-Fisheries compliant self-cleaning screen structure at the upper intake (constructed in 2013 and modified in 2016), and one older (1946) water intake located about 100 yards downstream of the newer intake. The older intake is now used as back up in case of failure of the newer water intake.
- 1 Big Quilcene River Pre-Settling Basin with two rotating drum screens to remove debris prior to use in raceways.
- 1 Penny Creek Intake that has two NOAA-Fisheries compliant inclined screens (one for raceways) and a separate concrete settling area for water delivered to the hatchery building.
- 39 8x80 ft concrete raceways, with 20 raceways currently covered by shade structures.
- 1 concrete weir and 2 fish ladders: one into the hatchery receiving channel; the other can be operated to provide fish access to the Big Quilcene River upstream of the weir.
- 1 Off-Line Settling basin
- 1 Spawning Shelter
- 1 Electric Weir which is currently not operated or connected electrically.
- 1 7-vehicle Hatchery Shop Building with maintenance office, built-in hazardous storage room (gasoline and diesel cans), and feed storage area.

- 2 wells:
  - Well 1 provides water for the Isolation Building for fish culture.
  - Well 6 is designated for domestic water and is connected to the domestic water treatment system (chlorination filtration). The domestic water treatment system consists of water softener, chlorine monitor, chlorine injection system, two bag filters, chlorine contact chambers, and a 12,000 gallon enclosed concrete reservoir. The well is run on Mondays, Wednesdays, and Fridays to fill the 12,000 gallon concrete tank. From there, water is gravity fed to the hatchery building and residences for domestic use when the pump is not running. Water pressure for fire hydrants on the main NFH grounds is 90 PSI. Water pressure is reduced to the buildings on the NFH grounds. Water pressure to Quarters 4 and its adjacent fire hydrant is 40 PSI (since it is closer in elevation to the concrete storage tank). Fire prevention sprinkler systems are installed in Quarters 4 and 7 and connected to the domestic water tank.

Raceways at Quilcene NFH

There are four banks, A, B, C, and D. They may all use first pass water if it is available, and flows are approximately 500 to 600 gpm per raceway. The A and C-bank raceways must always use first pass water. The C-bank raceways were constructed with a water head level problem and must use first-pass water directly from Penny Creek or the Big Quilcene River. There may be insufficient water in Penny Creek during spring and summer months.

The serial reuse system can transfer water from A to B bank (second pass) and then to D bank (third pass) or may transfer water from C to D (second pass). Currently, water is re-used in B and D-bank raceways for about four months of the year. Fish destined for transfer to the Quilcene Bay net pen are reared in A bank until the fall when river flows increase to a point where there is an adequate amount of water available to rear the fish on first pass water in C bank. The C-bank raceways are used from the end of December through March for the net-pen fish and are empty the rest of the year due to lack of adequate water-head level. The fish are moved from A-bank to make room for young-of-the-year coho salmon. The on-station release portion of the program uses nine B-bank raceways and six D-bank raceways. Fish are moved each year from the nine A-bank raceways to three D-bank and six-C bank raceways; they are not

squeezed into a fewer number of raceways. These raceway populations are roughly equivalent to those on B bank, and so there is not a difference in density among raceways at release time.

Rearing parameters for coho salmon

For the coho program, the 600 gpm flows allow for complete raceway turnover approximately every 15 minutes. Fish marking typically takes place between late May and mid-June, and marking and splitting from "A" bank to "B" and "D" banks is completed before the fish exceed a Density Index of 0.20. However, the density index may reach 0.25 during the latest period of rearing before smolts are released on-station.

Fish propagation water sources and water rights

The hatchery has a basic Big Quilcene River water right providing 15 cubic feet per second (cfs), regardless of flows within the river. Big Quilcene River water is currently used in the outdoor raceways only.

In 1991, an additional Big Quilcene River water right was secured providing up to an extra 25 cfs withdrawal depending on flows and time of year. This flow is measured via staff gage in the "bypass reach", the area of river between the hatchery intake and water discharge structures. From July 1 through February 28/29, a minimum of 50 cfs must be maintained in the bypass reach, and from March 1 through June 30, there must be a minimum 83 cfs left in the bypass reach. In other words, the NFH may withdraw additional water up to a 40 cfs rate (15 cfs old water right + up to 25 cfs newer water right = 40 cfs maximum) so long as the prescribed flows in the bypass reach do not decrease below the aforementioned minimums at the required times of the year. But the hatchery can withdraw the basic 15 cfs of Big Quilcene River water regardless of the flows within the bypass reach.

The hatchery has two water rights on the second source, Penny Creek – one for 10 cfs and a later one for 15 cfs for a combined total of 25 cfs. Penny Creek is the sole water supply within the main hatchery building and is also plumbed to all raceway banks. Penny Creek is also capable of providing emergency water within the Isolation Building to avert a catastrophic fish loss (such as failure of both well pumps or emergency generator where these cannot be quickly restored to service).

The Isolation Building is supplied by a ground water source, Well #1. The water right for this source is 320 gpm.

Other water users in the Big Quilcene River watershed

The City of Port Townsend and that town's paper mill (Port Townsend Paper Corporation) have co-ownership of a Big Quilcene River water right predating, and upstream of, that of Quilcene NFH. However, those users now voluntarily leave a minimum 27 cfs flow in the river.

Water use at Quilcene NFH

The Big Quilcene River provides the majority of the water used in the outdoor raceways and is used almost exclusively on both "A" and "B" banks. "D" bank water use is more variable and is commonly operated on either Big Quilcene River or Penny Creek water.

Penny Creek supplies all water for incubation of both "green" and eyed eggs in the hatchery building and is the source used to rear coho pre-smolts on "C" bank for the majority of the Skokomish Tribal Net Pen Program.

Well #1 is currently used only within the Isolation Building. The water to the incubation stacks can be chilled and used for otolith marking; water supplied to the rearing tanks is ambient only. There is a SAMMS project in place to establish greater chilling capacity within the Isolation Building.

Water temperature

Since Quilcene NFH began operations in 1911, a variety of surface water temperature records have been made for both our Penny Creek and Big Quilcene River sources. These records range from hand-written records to thermograph charts to periodic downloads from temperature logging units to the computer-based system in use today. The usefulness of those data is unknown because of uncertainties regarding the accuracy of the wide range of methods and equipment that were used to measure temperature since 1911. However, since 2010 when the last NPDES permit was issued, Quilcene NFH has used a certified thermometer to cross-check all temperature measuring devices at the hatchery.

Issues relating to water flow and/or temperature

Penny Creek is a generally great source in regard to water quality, but less so in regard to water quantity. Penny Creek water temperatures are more stable (less seasonal fluctuation) than that of the Big Quilcene River; Penny Creek is warmer in the winter and cooler in the summer. The main drawback regarding Penny Creek is that it is driven more by rainfall and thus shorter-term precipitation patterns. Flows are ample in the late fall to late spring time period when the weather is generally wetter. By August and September, flows are probably down to only a few hundred gallons per minute at most. Penny Creek also doesn't have a pre-settling basin for the raceways, so silt, sand and fine debris tend to accumulate in the headboxes and raceways to a greater extent.

The Big Quilcene River source, by contrast, is influenced not only by rainfall in the lower elevations, but also by the amount of snowpack deposited at the higher elevations. The Big Quilcene River source has an ample pre-settling basin, and recently, NOAA-compliant fish screening (coupled with a brush-style cleaning apparatus) was installed at the upper water intake area. While water temperatures of the Big Quilcene River vary more than those of Penny Creek on an annual basis, they remain within a range that is conducive to rearing quality fish without major problems. Ectoparasite loads are tolerable, and treatments are very rarely needed. The surface of the water in the raceways may occasionally freeze over in the winter, but these periods tend to be of short duration and do not cause undue difficulty.

The Well #1 ground water source is of good quality and of course has no issues inherent with surface water supplies (muddy water events due to storms, etc.). During the time the Hood Canal Steelhead Project was housed in the Isolation Building (typically from mid-March through late August/very early September), ambient water temperatures in the 7-8 °C range were observed.

A pilot program to test the feasibility of using the Isolation Building for eyeing up and otolith marking of Lake Sammamish kokanee salmon was performed from November 17, 2010 through February 1, 2011. Ambient temperatures for the Well #1 source were in the ~9 °C when operations began, and dropped to ~8 °C range by February 1st. This ground water source is apparently subject to seasonal temperature influences.