APPENDIX E. WORK GROUP MEETING NOTES, JANUARY 27, 2021

Warm Springs National Fish Hatchery Climate Change Vulnerability Assessment: Virtual Meeting to discuss projected impacts and adaptation strategies

I. Overview of meeting.

A. Meeting participants, U.S Fish and Wildlife Service:

Andy Goodwin, Ann Gannam, Bill Gale, Chris Pasley, Christian Smith, Dan Nehler, David Hand, David Thompson, Denise Hawkins, Don Campton, Doug Olson, Doug Peterson, Katie Royer, Kyle Hanson, Mike Clark, Patty Crandell (moderator), Terry Freije, Tom Sinclair,

B. Meeting participants, Warm Springs Tribes, Natural Resources Branch:

Lyman Jim, Mark Manion, Ryan Gerstenberger, Ron Suppah

C. Purpose of meeting:

Identify potential adaptive strategies for Warm Springs NFH and Spring Chinook Salmon in the Warm Springs River watershed to mitigate the impacts of future climate projected for the 2040s.

D. Facilitator's personal note:

The meeting was very productive with an active and open discussion. Comments listed below are not attributed to any particular participant but were recorded as they were spoken. The sequence of comments under each impact may have been re-ordered slightly to facilitate flow of these transcripted notes.

E. Adaptive Capacity: definition and concept:

Adaptive capacity is the existing ability or capacity of a system or species to adjust or adapt to the impact of an environmental disturbance such as climate change.

In the context of assessing the vulnerability of human communities (e.g., NFHs), *adaptive capacity* often refers to the potential to implement planned adaptation measures to cope with change, including consideration of future strategies or potential changes that would *increase* the adaptive capacity of a system or species.

II. Adaptive measures: impacts to Spring Chinook Salmon at Warm Springs NFH (WSNFH).

A. Impact: Higher water temperatures of the Warm Springs River through the 2040s will challenge Spring Chinook Salmon biologically and will most likely lead to significant physiological stress at several life history stages.

1. *Current adaptive measures:*

- Adult Chinook Salmon are collected for broodstock during the spring and summer and are maintained in holding ponds where water temperature is controlled through chilling. The adult ponds can be chilled down to 50 $\pm$ 3 °F at ~350 gpm flow. The hatchery is able to maintain those temperatures for adults throughout the summer. Adults are very "green" when they arrive at the hatchery. The number of adults trapped at the hatchery typically peaks between Memorial Day and June 1, with spawning occurring from late August to early September.
- The chillers are also used during egg incubation and early juvenile rearing in the nursery building. The hatchery has no control of water temperature in the outside raceways.
- Water inside the incubation building can also be heated by boilers.

2. *Potential future adaptive measures:*

- Chill water in the outside adult holding ponds to 60 – 65 °F during the summer instead of going down to the optimum temperature of 50 °F when the Warm Springs River reaches the critical temperature of 72 °F; this measure could yield some cooling capacity for juveniles in raceways. However, this measure would most likely be impractical with existing infrastructure.[1]
- Groundwater from wells does not appear to be an immediately feasible adaptive measure for obtaining cool water. Water temperature in a test well was 130 °F (geothermally heated).[2] However, the well for domestic water does provide cool water, so it might be possible to drill an exploratory well that taps into the same cool water.[3]
- Use WSNFH as an adult collection and smolt-release facility, but rear the juveniles off station at another NFH (e.g., Little White Salmon NFH) or at a rearing facility on the Deschutes River (e.g., Round Butte State Fish Hatchery). "Shifting the rearing of juvenile Chinook Salmon to Round Butte SFH or a Gorge facility are realistic." "Rearing fish on the Deschutes River could create a new fishery opportunity for the Tribe that would be worth exploring."

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[1] Approximately 10,750 gpm of ambient river water are supplied to the raceways, but the current chilling system has a capacity to chill only 370 gpm down to 50 °F. At most, only 100 gpm of chilled water (< 1% of total required water for raceways) could be added to the main water line for the raceways and still maintain sufficient chilling capacity of the adult ponds. Terry Freje, Manager, Warm Springs NFH, personal communication.

[2] It might be possible also to use geothermal ground water in winter to replace boilers and save costs. The energy cost of operating the boilers in winter is greater than the cost of operating the chillers in the summer and fall.]

[3] The recharge rate of the domestic well is unknown, although it is sufficient to meet domestic water needs of the hatchery and staff.

- Build a Partial Reuse-Water Aquaculture System (PRAS) equipped with chilling at WSNFH. Cost: ~ $11.1 – $12.4 million to rear 750,000 smolts (20 fish per pound) as per a 2017 engineering study.[4]
- Rear Spring Chinook Salmon in the upper watershed at Schoolie Springs, about 27 miles upstream of the hatchery. Cost: ~ $10.6 million to rear 750,000 pre-smolts (30 fish per pound) on single-pass water or ~ $9.8 – $11.3 million to rear 750,000 pre-smolts in a PRAS. The 2017 engineering report includes a design for a PRAS and fish rearing facility at Schoolie Springs. Groundwater from the Schoolie Springs site would not require chilling, but providing 3-phase electricity to that site would be a major expense (~ $1.05 million).[5]
- What about rearing a different stock/species at WSNFH if the Warm Springs River becomes less habitable for Spring Chinook Salmon? Does the Tribe have ideas/preferences for alternative species?
  - Spring Chinook Salmon is the most desired species for the Tribe.
  - Coho Salmon may be one possibility. The number of Coho Salmon ascending the Warm Springs River has increased in recent years. Staff at WSNFH passed over 400 wild Coho Salmon upstream in 2019 and over 700 wild coho in 2020. "It would be a bold move to switch to Coho Salmon, but it is possible." However, maintaining Coho Salmon juveniles at WSNFH during the summer could be problematic – just like it is for Spring Chinook Salmon – because of higher than desired temperatures of the Warm Springs River.
  - What about Fall Chinook Salmon? A relatively healthy population of Fall Chinook Salmon exists in the Deschutes River and could be a broodstock source. "Perhaps WSNFH could do a potential trade with a hatchery in the Columbia River Gorge where WSNFH would rear Fall Chinook Salmon in exchange for a Gorge hatchery rearing Spring Chinook Salmon from the Warm Springs River? Under this scenario, total production of both species/strains would remain largely unchanged."
  - Maybe a "split program" is possible at WSNFH (e.g., Spring Chinook Salmon + Fall Chinook Salmon)?

B. Impact: Higher water temperatures of the Warm Springs River in the future are expected to further increase disease risks, particularly to juvenile salmon during the summer months and adults during broodstock collection and when they are maintained on station prior to spawning.

1. ***Current adaptive measures:***

- Adults are given formalin treatments three to four times per week until spawned.
- The adult holding ponds have been modified in recent years and are now provided with chilled water, as note previously.
- Incubating eggs are given formalin treatments.
- Water temperatures in the nursery tanks are kept close to 50 °F via chilling

[4] McMillen Jacobs Associates, Consulting Engineers (https://mcmjac.com/). Note: Specifications presented here in these notes regarding the costs and capacities of a PRAS at WSNFH or Schoolie Springs were obtained from the engineering report and inserted by the facilitator after the meeting when the notes were finalized.
[5] McMillen Jacobs Associates, Consulting Engineers (https://mcmjac.com/).

- All water supplied to the adult ponds and nursery building goes through a sand filter and UV sterilizer.

2. ***Potential future adaptive measures***

- **Background:** Outside raceways are where fish health risks are greatest. Fish in raceways receive little treated water. Most diseases are stress mediated. In addition, introduced pathogens can interact with existing pathogens to increase disease impacts (e.g., interaction effects between Columnaris and Ich).
- Develop a PRAS for rearing juvenile Spring Chinook Salmon. A PRAS system connected to a chilling system with both mechanical filtration and UV sterilization would reduce both water temperature and disease risks. A pilot PRAS study with Spring Chinook Salmon is currently underway at Leavenworth NFH. Estimated cost to develop a PRAS at Warm Springs NFH: ~ $11.1 – $12.4 million to rear 750,000 smolts (20 fish per pound) as per a 2017 engineering study.[6]
- Some juvenile fish will be test-reared indoors during the summer of 2021 to evaluate whether mechanical filtration and UV sterilization can reduce incidence of disease on juvenile Chinook Salmon. Surface water needs to be filtered mechanically before going through UV, and mechanical filtering at that level also reduces pathogen load. A tradeoff between mechanical filtration and UV might be possible for the outdoor raceways at Warm Springs NFH to reduce disease risks and dollar costs.
- Expand the disinfectant system with additional UV or add an ozone facility.[7]
- Fish Health staff hope to implement a vaccine this year for Columnaris to reduce use of antibiotics.
- Reduce program size to reduce density index (DI), flow index (FI), and disease risks. This adaptation measure would also reduce the number of broodstock that are needed. In recent years, the number of juvenile fish reared on station has been less than the release goal. For example, in January 2021, WSNFH had only 250,000 brood-year 2020 fish on station compared to a release goal of 750,000 smolts.

C. Impact: Although higher water temperatures are projected to increase growth rates of Spring Chinook Salmon, flow index (FI) and density index (DI) values projected for the 2040s are still within generalized fish health guidelines (FI < 1.0; DI < 0.2) but would most likely exceed the more stringent guidelines of FI < 0.6 and DI < 0.1 recommended currently for Warm Springs NFH. In addition, pump cavitation has occurred in the past during very low flows of the Warm Springs River in summer, thus reducing flows to the raceways, although sufficient water was in the river to meet the water rights and needs of the hatchery.

1. ***Current adaptive measures: none identified.***

2. ***Potential future adaptive measures:***

- FI has not been an issue in recent years. WSNFH has had sufficient water to maintain FI < 0.6 because of lower numbers of fish reared on station. As such,

[6] McMillen Jacobs Associates, Consulting Engineers (https://mcmjac.com/).

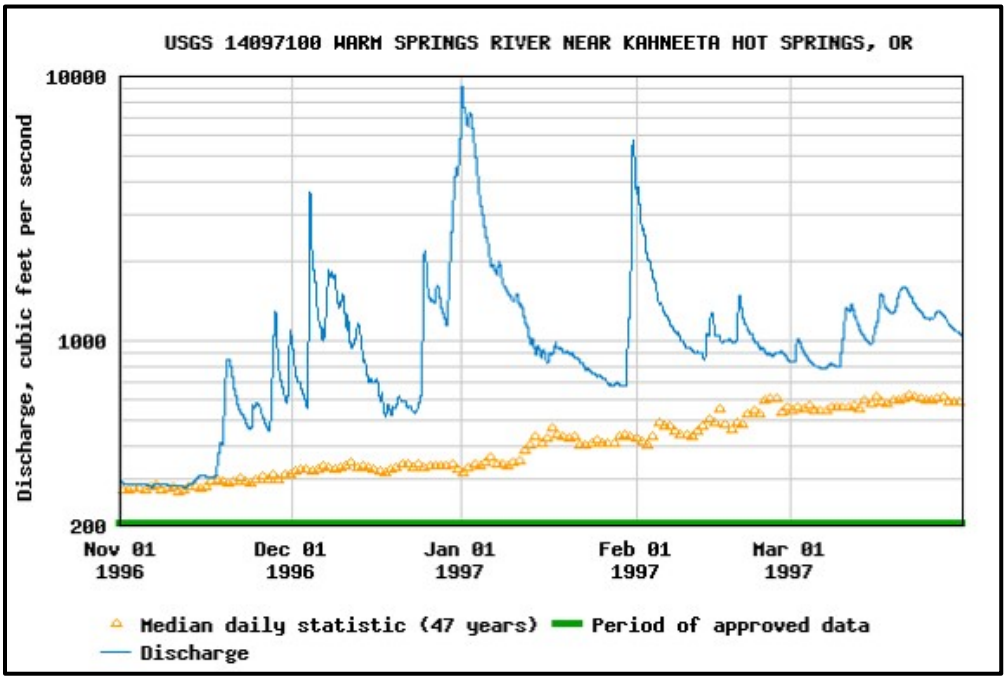
[7] Facilitator's note: Coleman NFH in California, which also raises Chinook Salmon, uses an ozone plant to disinfect the source water from Battle Creek, the primary water supply for fish culture at the hatchery.

reducing the production goal of 750,000 smolts would be potential adaptation strategy to maintain FI < 0.6 in the future.

- To ensure proper functioning of the pumps during low summer flows of the Warm Springs River, improve or replace the water intake structure to increase the quantity of water available to the hatchery. This is already a planned construction project (see discussion under impact #4 below). With permits, the USFWS may be able to start construction in 2023.
- Fish growth can be modulated to adapt to warmer water so that they don't achieve the larger sizes projected from the climate and fish growth models (e.g., by reducing feed). Reducing feed levels would also increase the concentration of dissolved oxygen, an additional benefit.
- Reduce flow indexes in raceways by removing a dam board at the tail end of each raceway to increase water turnover rates of raceways. In general, water turnover rates are a better measure of overall water quality than FI values.
- Install a PRAS to allow for higher FI and DI values, if needed to maintain production goals.

III. Adaptive measures: impacts to hatchery infrastructure.

A. Impact: Transition of the Warm Springs River from primarily a snowmelt-driven watershed to a mixed snow-and-rain-driven watershed is expected to significantly increase flood risks to Warm Springs NFH by the 2040s. A prelude to the magnitude of projected floods occurred in late December 1996 and early January 1997 during a major flood (see figure below).



1. ***Current adaptive measures: none identified.***

2. ***Potential future adaptive measures:***

- Construct a new water intake for the hatchery, currently a high priority for WSNFH. High flow events in the past have damaged/displaced the drum screens for the water intake. The new intake and screen desired for WSNFH would be below the water surface and would be less vulnerable from floating debris during high flows than the current drum screens. A new screen would also be more self-cleaning than the current screen.
- Install an Obermeyer gate in the current weir to reduce backwater behind the weir and flood risks to the hatchery during high flows.
- Construct an earthen berm around the hatchery to divert flood waters around the hatchery.
- Construct new facilities outside the floodplain to reduce flood risks; this new location might be the preferred location for the proposed PRAS.

B. Impact: Higher mean air temperatures during the spring and summer, coupled with little change or slight decreases in mean monthly precipitation, are expected to increase fire risks to Warm Springs NFH through the 2040s and beyond.

1. ***Current adaptive measures***

- WSNFH is currently surrounded by a water-driven fire suppression system. The hatchery currently has a water cannon system around the facility and sprinklers on the north side of the hatchery. This suppression system draws water from the 36-in diameter pipe to the raceways. Hatchery staff currently keep areas around the residences and facility watered and mowed.
- Malheur NWR has a fire crew on station that could be called in an emergency. However, the refuge is approximately 225 miles away, approximately a four-hour drive to the hatchery.
- Two boats are currently available that could be used for emergency egress from WSNFH to the other side of the Warm Springs River if the road to the hatchery was inaccessible because of a rapidly moving wildfire.
- All staff have cell phones that can be used for emergency communications. The cell phone tower is one ridge line from the hatchery, and cell phones have worked in the past during wildfires. The cell phones have very good coverage depending on location at the hatchery.

2. ***Potential future adaptive measures:***

- Modify a fish hauling truck, currently maintained at Little White Salmon NFH, as a water tender and maintain the truck at Warm Springs NFH during the summer.
- Provide fire-fighting training to hatchery staff. None of the current hatchery staff has fire-fighting certification (red cards).
- Install metal roofs on residences when current fiberglass shingles need replacement. The hatchery buildings currently have metal roofs.
- Cut down junipers around hatchery.
- Risks to fish on station? Would water to raceways be diverted for firefighting? If staff need to evacuate due to fire, emergency release of fish into river would occur. Water tenders do go down to the hatchery to refill their tanks.

IV. "Big Picture" ideas: How can we meet comanager goals in view of projected climate change impacts?

1. Build a centralized PRAS facility at WSNFH with satellite acclimation and release sites at multiple locations including the upper Warm Springs River watershed (e.g., Beaver Creek, Shitike Creek) and upstream of Shearers Falls on the Deschutes River (e.g., at the White River confluence). [Note: The Tribe had a fishery on the Warm Springs River, but the fishery has been closed for many years. The fishery for Summer Steelhead on the Warm Springs River is also closed. The major fishery for Spring Chinook Salmon currently occurs at Shearers Falls. This is a high-value fishery to the Tribe.]
2. Install water filtration, UV sterilization, and chilling capacity for water supplied to raceways, either for the current single pass system or as part of a PRAS.
3. Move the hatchery to the mouth of Warm Springs River to access Deschutes River water. [Note: The group also discussed the current location of Round Butte Hatchery at the base of Round Butte Dam as a possible alternative location for WSNFH. The group noted that Round Butte Hatchery is located between the toe of the dam and the powerhouse and that space for another hatchery was most likely not available at that specific location.]
4. The Tribe does not want Spring Chinook Salmon to go extinct in the Warm Springs River. This population is viewed as a unique resource that the Tribe wants to maintain.
   - Implement conservation measures to prevent extinction of Spring Chinook Salmon in the Warm Springs River.
   - If necessary as a last resort, develop a captive broodstock program for Spring Chinook Salmon at WSNFH with a potential satellite facility in the upper watershed and off-station rearing of juveniles. However, captive broodstock programs for Spring Chinook Salmon in the upper Columbia River have not fared well (early maturation, disease, etc.).
5. "Big picture" adaptive measures suggested during the workshop but beyond the purview of the USFWS and fishery comanagers:
   - Adjust or modify operation of the Round Butte Pelton Dam complex to ensure cool water flow down the Deschutes River during critical migration times.
   - Remove the Pelton RB Dam complex to restore free passage of salmon and Steelhead to the upper Deschutes River.
   - Remove the The Dalles Dam to reduce water temperatures in the mainstem Columbia River and restore the tribal fishery at Celilo Falls.

V. Next steps.

1. Complete the CCVA draft report for Warm Springs NFH including the Adaptation and Vulnerability sections.
2. Review and revision of the draft report by the USFWS Hatchery Evaluation Team.
3. Review of the revised draft by USFWS managers in the Regional Office.
4. Finalization and posting of the CCVA report for Warm Springs NFH.