

## APPENDIX C. WORK GROUP ADAPTATION MEETING NOTES, AUGUST 25, 2021

### Entiat National Fish Hatchery Climate Change Vulnerability Assessment: Meeting to discuss projected impacts and adaptation strategies

#### I. Overview of meeting.

##### A. Work group participants, U.S Fish and Wildlife Service:

Andy Goodwin (CCVA Team), Bill Gale (CCVA Team), Christine Parker-Graham (Fish Health Veterinarian), Craig Chisam (Hatchery Manager), Dan Nehler (RO Supervisor), Don Campton (CCVA Team), Doug Peterson (CCVA Team), Jim Craig (Complex Manager), Kyle Hanson (CCVA Team), Matt Cooper (Fish Biologist), Patty Crandell (CCVA Team), Tom Sinclair (RO Supervisor), Travis Collier (Assistant Hatchery Manager)

##### B. Work group participants, U.S. Bureau of Reclamation:

David Child (Natural Resources Project Manager)

##### C. Purpose of meeting:

Identify strategies and the adaptive capacity of Entiat NFH to adapt or mitigate for climate change impacts projected for the Entiat River watershed and the Summer Chinook Salmon program by the 2040s.

##### D. 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.*

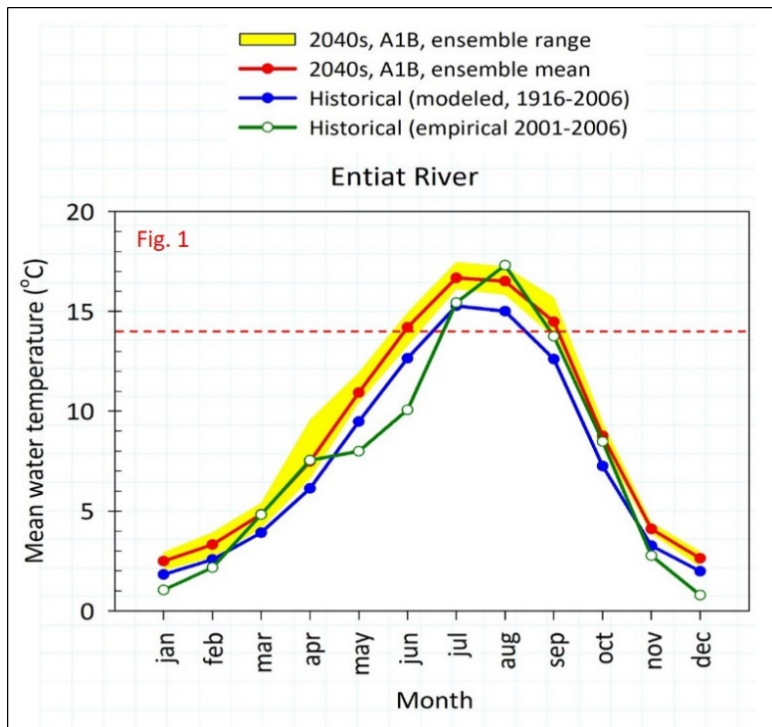
In the context of assessing the vulnerability of human communities (e.g., NFHs), *adaptive capacity* often refers to the potential to implement planned adaptation measures to cope with change, including consideration of future strategies or potential changes that would *increase* the adaptive capacity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

Note: In the following sections, impacts identified by CCVA Team are preceded by capital letters (A, B, etc.), and responses by the Work Group are listed as bullets.

#### II. Adaptive measures: Impacts to Summer Chinook Salmon at Entiat NFH.

##### A. Impact: Mean monthly water temperatures of the Entiat River adjacent to the hatchery are projected to increase in the 2040s by an average of 1.2 °C (range = 0.7 – 1.9 °C) with mean projected temperatures in July and August of 16.7 °C and 16.5°C, respectively (see following figure).

Higher temperatures of the Entiat River in summer (14.5 to 16.7 °C) exceed the upper optimal temperature for adults (14 °C) and could (a) increase the incidence of disease among upstream-migrating adults trapped for broodstock and/or (b) reduce the ability of the hatchery to trap broodstock if high water temperatures impede upstream migration.



**1. Disease risks to trapped adults, adaptive measures:**

- In general, disease issues at Entiat NFH have been minimal in the past. Adult Chinook Salmon returning to Entiat NFH are captured for broodstock from early July through the first week of October but are transferred to holding ponds supplied with groundwater until they are spawned early to mid-October. This is one reason why disease issues have been minimal at Entiat NFH.
- If disease becomes an increasing issue in the future, fish health staff recommends case-specific treatments, as needed. For bacterial pathogens/diseases, antibiotics may be necessary, but their use should be minimized and targeted to specific isolated pathogens.
- Although watershed-specific vaccines can be developed, they are generally most appropriate in anticipation of enzootic outbreaks while fish are on station or prior to release.
- At other hatcheries, we know which pathogens are problematic with warmer water. However, there are few issues with pathogens at Entiat NFH, so forecasting which pathogens in the future may become a clinical concern is difficult.
- Potential adaptation strategy: provide additional groundwater and/or mechanically-chilled surface water to the adult capture pond and ladder to reduce water temperatures and disease risks.

**2. Broodstock collection risks, adaptive measures:**

- Entiat NFH currently receives 2,000-4,000 adults back to hatchery. However, only 150 females and 150 males are typically needed to meet the 400,000 smolt release objective of the program. Consequently, fewer adults back to the hatchery is not anticipated to be a problem in the future, even with warmer water temperatures of the Entiat River in summer.

- A good pulse of fish arrives in July and August, then a pulse of fish arrives at the hatchery right before spawning in late September. Adults may be holding in the Columbia River in cooler areas before heading upstream in September. As such, the hatchery may see fewer adult fish arriving in July and August but more fish arriving in late September. These potential changes in return timing could be an area of concern if the Columbia River can no longer provide thermal refugia from a warmer Entiat River.
  - This potential impact related to return timing and broodstock availability may not affect hatchery operations significantly. However, providing surplus fish to the Tribes is really important, and that priority could be affected if fewer sexually immature fish arrive in early summer but large numbers of less-palatable sexually-mature fish arrive in late September.
  - This potential impact could be a logistic issue for the hatchery if large numbers of fish in excess of broodstock needs arrive in late September. If this occurs, additional personnel may be needed temporarily to assist with sorting and surplusing of fish prior to spawning.
- Water temperatures in 2021 already look similar to projections for the 2040s.
- Higher water temps may affect tributary fisheries on Summer Chinook Salmon.
- Overall, the Work Group did not believe that the higher temperatures projected for the Entiat River in the 2040s would impede the ability of the hatchery to meet their broodstock goals, assuming (implicitly) that Summer Chinook Salmon would be able to migrate up the Columbia River to the confluence of the Entiat River.

**B. Impact: Chinook Salmon smolts at Entiat NFH in the 2040s are predicted to be approximately 15% heavier and 5% longer at release than historically because of warmer water temperatures, assuming no change in current culture protocols.**

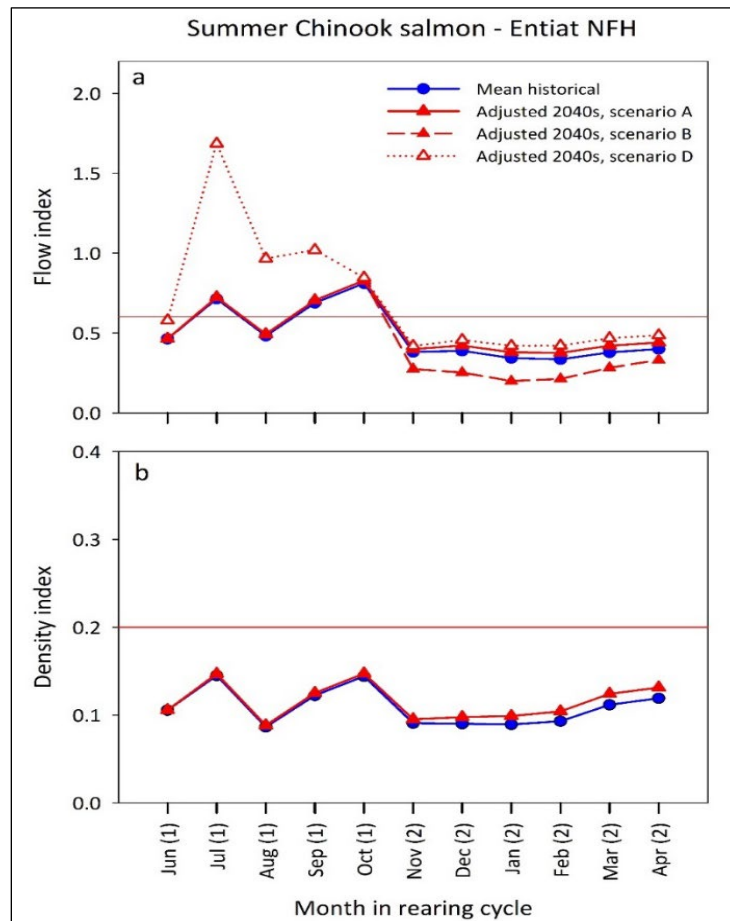
- This impact is not a big concern. If it becomes a problem in the future (e.g., precocious maturation of males), the hatchery can extend the period of chilling. This impact probably would not require much change in feeding regimes.
- Slightly warmer water temps in winter could actually be a bonus by reducing icing conditions.

**C. Impact: If groundwater availability during the summer decreases in proportion to lower base flows of the Entiat River (modelled Scenario D), then flow index (FI) values are projected to increase substantially during July, August and September (peak FI > 1.6) when subyearlings are maintained on 100% well water (see figure on next page).**

How can Entiat NFH adapt if groundwater availability during the summer decreases in response to lower base flows of the Entiat River?

- High quality groundwater at Entiat NFH during the summer allows higher flow indexes than guideline values for Spring/Summer Chinook Salmon at other hatcheries ( $FI \leq 0.6$ ) where surface water is used during the summer for rearing juvenile fish and where high water temperatures may be an issue. “At Entiat NFH, groundwater is gold! A lower quantity of high quality water is better than a high quantity of lower quality water.”
- Securing the current groundwater supply and new sources of groundwater are current needs at Entiat NFH. The hatchery recently purchased an adjacent 10 acres that could be explored.

- Wells are actively maintained currently. However, the hatchery needs funds to maintain the wells. Money is needed also to rehabilitate the groundwater facilities because the infiltration gallery is not receiving as much water as it should be receiving. Flat budgets make it difficult to maintain wells and groundwater supplies. A change is desired for how maintenance funding is obtained. Resources should be expended on (a) maintaining the current groundwater infrastructure and (b) searching and developing new sources of groundwater for the future.
- The entire hatchery could be run on groundwater alone if an additional 1,000 gpm is available through the infiltration gallery.



- Recommendations:
  1. Add a third water collection line to the infiltration gallery to potentially increase flows and yield.
  2. Establish a budgeted maintenance and rejuvenation schedule for the wells and infiltration gallery (e.g., every 5 years) to maximize groundwater flows into the wells and infiltration gallery (e.g., AquaFreed process).
  3. If groundwater availability during the summer does decrease significantly in the future *and* other possible adaptive measures are insufficient to safely maintain Summer Chinook Salmon on station during the summer, then a partial-reuse aquaculture system (PRAS) could be developed as a last resort to reduce overall groundwater demands. However, this adaptive measure would require a significant reworking of the plumbing and water supply systems at the hatchery.

### **III. Adaptive measures: impacts to hatchery infrastructure.**

**A. Impact: Transition of the Entiat River from primarily a snowmelt-driven watershed to a mixed-snow-and-rain-driven watershed is expected to increase mean monthly flows of the Entiat River by approximately 65% from November through April in the 2040s. In addition, 100-year peak flows of the Entiat River are projected to increase from about 8,000 cfs historically to nearly 14,000 cfs by the 2040s, thus increasing flood risks.**

- The biggest concern is debris associated with high peak flows. High flows of the Entiat River come with mud or ice or both which can impede water flows or clog the sand-settling basin. “If we had more groundwater available from the infiltration gallery, then we could shut down the water intake from the Entiat River and rely on 100% groundwater with serial reuse.”
- The 100-year flood risks are in the area of the wells, not the hatchery buildings and raceways.
- Flooding would most likely not affect the physical infrastructure of the hatchery.

**B. Impact: Higher mean air temperatures during the spring and summer, coupled with slight decreases in mean monthly precipitation, are expected to increase fire risks to the Entiat River watershed and Entiat NFH through the 2040s.**

- Fire at the hatchery is not as big of a concern as mud, ash and debris washed into the Entiat River from upper watershed after major fires have occurred.
- Entiat NFH has had several inches of mud and debris in raceways that washed down from the upper watershed following fires. Such debris flows can pose a fish health risk by introducing pathogens into raceways and/or increasing fish stress due to poor water quality.
- Is there an egress risk to hatchery staff if a large fire occurred downstream from the hatchery? Work Group answer: “This is probably not much of an issue; there is a secondary gravel road to Leavenworth if evacuation of the hatchery was necessary.

### **IV. Other issues?**

- Higher impacts of Summer Chinook Salmon from Entiat NFH to ESA-listed Spring Chinook Salmon in the Entiat River could increase environmental regulations and constraints upon hatchery production and operations.
- Funding. Maintaining infrastructure for keeping the groundwater flowing is critical but requires reliable funding.
- Conclusion: Some of the greatest sensitivities for Entiat NFH may relate to deferred maintenance of hatchery infrastructure, particularly the wells and the infiltration gallery.

### **V. Next steps in the CCVA process for Entiat NFH.**

1. Complete the CCVA draft report for Entiat NFH, particularly 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 Entiat NFH on the USFWS website.