



To: Jon Barrett
Resource Conservation District of Tehama County

From: Jay Stallman, PG
Stillwater Sciences

Date: September 15, 2020

Re: Final Passage Assessment and Flow Recommendations for Chinook Salmon and Steelhead in Lower Antelope Creek

Please advise interested parties of the completed Final Passage Assessment and Flow Recommendations for Chinook Salmon and Steelhead in Lower Antelope Creek (Passage Assessment), prepared by Stillwater Sciences. A PDF file of the Final Passage Assessment report can be obtained from the Resource Conservation District of Tehama County (RCDTC) website. This work is a component of the RCDTC's Antelope Creek Fish Passage Improvement Project (Project), which consists of (1) a study to determine flow needs for fish passage in the lower Antelope Creek watershed and (2) design and implementation of retrofits to two existing water diversions in the lower Antelope Creek watershed, which are operated by the Edwards Ranch and Los Molinos Mutual Water Company. Most of the Project's funding was obtained from the Proposition 40 Integrated Watershed Management Program (IWMP) administered by the State Water Resources Control Board (State Water Board). Additional funding was also provided by the United States Fish and Wildlife Service (USFWS) Anadromous Fish Screen Program (AFSP) and Anadromous Fish Restoration Program (AFRP).

The goal of the Passage Assessment was to determine the timing and magnitude of minimum instream flows necessary to provide suitable conditions for adult and juvenile Chinook salmon and steelhead migration through lower Antelope Creek. The flows identified in the Passage Assessment are intended to provide suitable passage conditions for adult and juvenile Chinook salmon and steelhead between Edwards Diversion Dam and the Sacramento River based on the best available science and integration of the findings from the three main components of this study: (1) observed passage at Edwards Diversion Dam, (2) passage at critical riffles, and (3) stream temperature analyses and modeling. The recommendations incorporate varying degrees of protection within the range of documented passable flows in Antelope Creek based on hydrologic conditions (unimpaired median monthly flow) by month and water year type.

The Draft Passage Assessment was provided to the Antelope Creek Fish Passage Improvement Project Technical Advisory Committee (TAC) in September 2019 at a TAC and stakeholders meeting. Written comments on the Draft Passage Assessment were submitted by the California Department of Fish and Wildlife (CDFW) and Gallery & Barton, representing Jim Edwards and Los Molinos Mutual Water Company. Comments provided by CDFW acknowledged that the authors had addressed a number of previous comments from CDFW staff, identified minor corrections, and suggested several areas where additional explanation would help clarify description of the study area, methods, analyses, and results. Comments provided by Gallery & Barton related to the life history and migration patterns for Chinook salmon and steelhead in Antelope Creek, estimated anadromous salmonid migratory travel times through lower Antelope Creek, water

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temperature and habitat requirements of migrating salmonids, and the use of depth criteria in the passage assessment.

Updates were made to the final Passage Assessment in response to the comments submitted by CDFW and Gallery & Barton. In addition to clarifications and other minor changes, these updates included the following:

Section 2.1, Life Histories for Focal Species and Life Stages

This section was updated to identify that: 1) adult anadromous salmonid migration timing in Antelope Creek is tied to migration timing in the Middle Sacramento River and is assumed to be similar; and 2) the occurrence and timing of adult Chinook salmon and steelhead observed at Edwards Diversion Dam in recent years may not represent the full historical migration period for Chinook salmon and steelhead under unimpaired flow conditions.

In addition, this section was updated to identify that Antelope Creek provides critical habitat for Central Valley spring-run Chinook salmon and California Central Valley steelhead, as discussed in the National Marine Fisheries Service (NMFS) Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the Distinct Population Segment of California Central Valley Steelhead.

Section 2.2, Geology and Geomorphology

This section was updated to state that Millrace Creek, a small tributary, bifurcates from mainstem Antelope Creek approximately 0.6 mile upstream of Edwards Diversion Dam during high flow events and connects to the Sacramento River via Salt Creek.

Section 2.4, Temperature Criteria

This section was updated to provide additional description of the figures. This section was also updated to identify that water temperature criteria for native coldwater fish have not been developed specifically for Antelope Creek. However, the U.S. Environmental Protection Agency (EPA) Region 10 developed Guidance for Pacific Northwest State and Tribal Temperature Water Quality that identifies maximum summer temperatures to protect coldwater salmonids in the Pacific Northwest. Elevated stream temperatures that exceed the EPA Region 10 summer maximum temperature criteria of 18-20° Celsius can occur in lower Antelope Creek during portions of the migration periods for anadromous salmonids.

Section 3.1, Observed Passage at Edwards Diversion Dam

This section was updated to provide additional rationale regarding estimates of anadromous salmonid migratory travel time through lower Antelope Creek. Although the minimum estimated migration time through the primary low flow migration corridor of lower Antelope Creek based on reported adult salmon and steelhead swimming speeds ranges from 4.9 to 6.2 hours, migratory travel time is naturally variable, and anadromous salmonids typically spend time holding or resting during migration. In addition, salmon and steelhead are known to adapt their movement and resting patterns according to diurnal cycles.

Section 3.2, Passage Conditions at Critical Riffles

This section was updated to provide additional information about the minimum depth criteria used in the Passage Assessment. In particular, Section 3.2 was updated to discuss that the minimum depth criteria used in the Passage Assessment and identified in CDFW's Standard Operating Procedure for critical riffle analysis were also included in the State Water Board's North Coast Instream Flow Policy and have been applied in other fish passage assessments.

Section 4.1, Observed Passage at Edwards Diversion Dam

This section was updated to provide additional discussion of fish passage observations in Antelope Creek, including the addition of Figure 4-1 displaying video observations of adult Chinook salmon and adult steelhead at Edwards Diversion Dam, 2014–2017. The occurrence and timing of adult Chinook salmon and steelhead observed at Edwards Diversion Dam during 2014-2017 may not represent the full historical migration period for Chinook salmon and steelhead.

This section was also updated with further analysis and discussion of water temperatures in lower Antelope Creek, including the addition of Figure 4-10, which displays the 7-day average daily maximum (7DADM) water temperatures associated with Chinook salmon and steelhead video observations at Edwards Diversion Dam.

Section 4.3, Stream Temperature Modeling

This section was updated to describe that the StreamTemp 2016 and 2017 simulations provide a reasonable approximation of stream temperature conditions under regulated and unregulated conditions in lower Antelope Creek. However, the StreamTemp simulations generally overpredict the actual (measured) daily maximum stream temperatures at locations in lower Antelope Creek by less than 1 degree Celsius (e.g., Craig Creek at SR 99) to approximately 2 degrees Celsius (e.g., near Edwards Diversion Dam).

Section 5.3, Recommended Minimum Passage Flows by Month and Water Year Type, and Section 5.4, Additional Considerations

These sections were updated to discuss that the flow recommendations presented in the Passage Assessment primarily focus on providing sufficient flow depths to allow for suitable Chinook salmon and steelhead passage through lower Antelope Creek based on water availability. However, suitable water temperatures are also needed to provide for fish passage. Ongoing temperature monitoring in lower Antelope Creek could provide real-time stream temperature information that could be used to inform flow management actions.

If interested parties have questions related to the final Passage Assessment, please direct them to contact Nicole Williamson at the State Water Resources Control Board at Nicole.Williamson@waterboards.ca.gov.

Best,



Jay Stallman