State of California
Department of Fish and Wildlife

Memorandum

Date: 4/30/2025

To: Eric Oppenheimer
Executive Director
State Water Resources Control Board

From: Charlton H. Bonham
Director
Department of Fish and Wildlife

Subject: **Healthy Rivers and Landscapes Habitat Restoration Design Criteria**

Introduction

Voluntary Agreements, also known as the Healthy River and Landscapes Proposal (HRL), are being proposed as an alternative approach to update the San Francisco Bay/Sacramento-San Joaquin Delta Estuary Water Quality Control Plan (Bay-Delta Plan). The entities proposing the HRL (HRL Parties) agreed to develop accounting procedures and implementation criteria to assure that habitat restoration provided under the HRL (1) are additive to physical conditions and regulatory requirements existing as of December 2018 (i.e. above baseline conditions); and (2) meet design criteria, acreage, and other targets (2022 Memorandum of Understanding (MOU) Sections 4, 8.4, and Appendix 4). These procedures are subject to approval by the State Water Resources Control Board (State Water Board).

In April 2024, the HRL Parties submitted proposed design criteria for spawning, in-stream rearing, and tributary floodplain rearing habitat as an appendix to the Draft Strategic Plan. In October 2024, the State Water Board released its Program of Implementation with the State Water Board's proposed design criteria for spawning, in-stream rearing, and tributary floodplain rearing habitat. In many respects, these two sets of design criteria are similar, however there are some outstanding differences between the two approaches. Specifically, there are differences with respect to (1) including a buffer around cover habitat and (2) tributary floodplain inundation frequency and duration.

Summary of Comments

- Cover Buffer – The majority of juvenile Chinook salmon are found within less than 2 feet from cover and a set buffer distance cannot be applied broadly to all cover types. There is little to no scientific support for the habitat suitability criteria that assumes 20% of restored

habitat providing cover is sufficient, nor the assumption that all cover can be combined with a uniform cover buffer.

- Tributary Floodplain Inundation Frequency and Duration – Short inundation (i.e. higher gradient) and long inundation (i.e. lower gradient) floodplain habitat types provide different functions and exist temporally and spatially explicit from one another, but are both important rearing habitat for juvenile salmonids. The HRL Parties' proposed targets for short and long inundation habitat are relevant to tributary floodplain restoration projects, whereas the Program of Implementation's proposed criteria, while proposed for tributary floodplain restoration projects, are more relevant to restoration projects conducted in floodplain bypasses.

Comments

Cover Buffer

Cover is a key element of freshwater rearing sites for juvenile salmonids as it provides protection from predators, helps them conserve energy, and allows them to ambush prey. It is therefore included as a design criterion along with water depth and velocity for instream and floodplain rearing habitat enhancement projects. Both the HRL Parties and the State Water Board propose a minimum of 20% areal coverage of cover features that have a Habitat Suitability Index (HSI) score ≥ 0.5. However, the HRL Parties propose applying a 3-foot buffer to this design criteria, such that all cover and the area surrounding cover (within 3 ft) would be included in accounting, while the State Water Board propose not applying a buffer. The HRL Parties cite two studies indicating that juvenile salmon forage within 3 feet of cover features (Hardy et al. 2006, Moniz and Pasternack 2019) to support their proposal that a 3-foot buffer is appropriate. While the State Water Board acknowledges these studies, it concludes there is not sufficient scientific literature to support 20% areal coverage with 3-foot buffered cover features as a habitat suitability criterion.

CDFW acknowledges a 2-foot buffer in which salmonids are present around cover types. Anadromous Fish Restoration Project monitoring in the upper Sacramento River found that almost all juvenile salmonids observed were found within 2 feet of cover habitat (Banet et al. 2020). This builds upon monitoring conducted on the Trinity River indicating that 2 feet is the maximum distance juvenile salmonids stray from cover (Goodman et al. 2015). In addition, it is important to note that cover complexity, cover type, and fish size affect the buffer distance (Holecek et. al 2009). Although CDFW has found scientific support indicating that juvenile salmonids move no more than 2 feet from cover habitat, that buffer distance does not serve the habitat functions of cover, including protection from predators. Applying any single buffer (in all directions) to all cover features without considering the type, size, location and complexity of the cover features, as well as water velocities surrounding the cover features and fish size, is not appropriate. Adding a 3-foot buffer on top of the 20% cover requirement inflates the total number of acres in a restoration site that are credited as cover, but do not

provide that function.

There is no substantial evidence in the scientific literature to support the conclusion that a minimum of 20% cover is sufficient to be suitable for juvenile salmonids. Raleigh et al. (1986) could not find any studies that estimated the amount of cover needed to support average densities of chinook salmon; their 20% recommendation was based on expert opinion. The consensus in the literature is that fish densities increase with the amount and complexity of cover (e.g. Raleigh et al. 1986; Hardy 2006; Holecek et al. 2009; Hellmair et al. 2018; Som et al. 2018; Gard 2023, etc.). The physical rearing habitat objective metrics for cover for juvenile salmon in the Central Valley developed for the San Joaquin Restoration Program (SJJRP 2012) and Stanislaus River (Anchor QEA 2019) are focused on an average HSI score ≥ 0.5; they do not include objectives for the amount of cover.

Tributary Floodplain Inundation Frequency and Duration

Intermittently or seasonally wetted areas that support floodplain hydrologic and geomorphic processes are highly productive ecosystems and provide critical rearing habitat for salmonids. Both the HRL Parties and State Water Board distinguish design criteria between tributary floodplain and floodplain bypasses. Bypass restoration projects are occupied seasonally by a broader range of native fish species and contain a unique set of challenges compared to floodplain restoration projects on the tributaries. Specific quantitative design criteria for bypass projects were not provided in the Strategic Plan or Program of Implementation due to the variety of fish species and life stages that are present in the bypasses.

The HRL Parties propose tributary floodplain habitat targets with sufficient frequency, magnitude, and duration of inundation to provide benefits for rearing salmonids that are consistent with the intention of the Meaningful Floodplain Event (MFE) described in the Final Draft Scientific Basis Report Supplement (SBRS)[1]. They include the following targets for (1) inter-annual frequency; and (2) intra-annual frequency based on inundation duration:

- Inter-annual frequency – Inundation 2 out of every 3 years on average and within a range of 50% to 80% of years.
- Intra-annual frequency
  - If duration is 7 to 18 days, floodplain projects should target at least 2 distinct inundation events. Grosholz and Gallo (2006) recommend repeated flood pulses at

[1] MFE criteria in the SBRS is defined as:
(1) Magnitude – 25% of habitat needed to support the doubling goal of the juvenile population
(2) Intra-annual frequency – Magnitude is met during at least 2 months during the rearing period
(3) Inter-annual frequency – Magnitude and intra-annual frequency is met at 2 out of every 3 years
(4) Duration – At least 7 days are needed and after 21 days there is minimal additional gain in productivity. SacWAM models in a monthly timestep so it is assumed an event will last at least 30 days.

intervals of 2- to 3-weeks, as drawdown between events can reset the productivity cycle once productivity rates have begun to stabilize or decline.

- If duration is >18 days, a single inundation occurrence during the February through June rearing period will satisfy the intention of the MFE criteria. Inundation habitat criteria in the Chinook Salmon Habitat Quantification Tool (HQT) for the CVPIA Science Integration Team assert that floodplain suitability is highest at 18-24 days.

In contrast, the Program of Implementation defines suitable inundation events as two inundation periods of at least 21 days' duration in two out of every three years or another period providing equivalent or greater benefits according to the science summarized in the SBRS or updated scientific information as approved by the Executive Director. This is based on the premise that to provide optimal benefits:

(1) Floodplain productivity peaks after 21 days of inundation (Grosholz and Gallo 2006; Yarnell et al. 2015), salmon spend 30-56 days on the floodplain on average (Sommer et al. 2005) and longer inundation provides greater benefits for life history diversity and growth (Goertler et al. 2017);
(2) Repeated flood pulses renew productivity and passage and reduce prey mismatch, so the most productive inundation pattern is multiple long-duration inundation events (Whipple et al. 2019; Grosholz and Gallo 2006); and
(3) Inundation is needed at least every 1.3 to 4 years, although it is most beneficial every year (Whipple et al. 2019; Yarnell et al. 2015; Matella and Merenlender 2015). The requirement for 2 out of 3 years (Williams et al. 2009) balances this and accounts for variation in salmon cohorts among years.

The rationale associated with the Program of Implementation criteria were about bypass floodplains where long inundation is needed to activate the food web. The literature does support the HRL Parties' proposed frequency and duration criteria for tributary floodplains. The Conservation Planning Foundation for restoring salmonids in the Stanislaus River (Anchor QEA 2019), distinguishes between (a) higher gradient off-channel and floodplain habitats, where short duration inundation can displace and distribute benthic and terrestrial invertebrates as prey and the frequency of inundation drives the timing of both habitat availability and increased prey density; and (b) low gradient floodplains where longer inundation times and extended solar exposure stimulates primary and secondary production that drive high prey densities. Both short inundation and long inundation floodplains serve functions of rearing habitat and as migratory "rest stop" and predator avoidance pathways for juvenile salmonids. Combined, in order for rearing habitat benefits to be realized for a given cohort, inundation must occur in 1 out of every 2 years (assuming a yearling life history strategy in some percentage of outmigrants) (Anchor QEA 2019). Anchor QEA (2019) inundation criteria are outlined in Table 1.

Table 1. Criteria for short inundation floodplain and long inundation floodplain habitat from Anchor QEA 2019.

Floodplain Habitat Type	Parameter	Range (Metric)
Short Inundation	Duration	1 to 9 wetted acre days
	Frequency	Minimum of 2 in 3 years recurrence interval during all years (minimum of 1 week drawdown to distinguish discrete event); Minimum of 1 event per year in wet years/years where inundation occurs
Long Inundation	Duration	10 to 21 wetted acre days
	Frequency	Minimum of 1 in 3 years recurrence interval; Minimum of 1 week drawdown to distinguish discrete event

Conclusion

CDFW commends the Department of Water Resources, State Water Board, and HRL Parties in their efforts toward developing habitat design criteria. It is not an easy task. CDFW is committed to engaging with all parties to discuss these outstanding issues with regards to habitat design criteria and habitat accounting.

Questions regarding this letter or further coordination should be directed to Brycen Swart, Environmental Program Manager, at 916-767-3089 or Brycen.Swart@wildlife.ca.gov.

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