Draft Application for a New License Major Project – Existing Dam

Applicant-Prepared Draft Essential Fish Habitat Assessment

Security Level: Public

Yuba River Development Project
FERC Project No. 2246

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Table of Contents

Section No. — Description — Page No.

1.0 Introduction 1-1
- 1.1 Purpose of the Essential Fish Habitat Assessment 1-3
- 1.2 Regulatory Framework 1-4
  - 1.2.1 Magnuson-Stevens Fishery Conservation and Management Act (16 USC §1801-1891d) 1-4

2.0 Essential Fish Habitat Background 2-1
- 2.1 1999 Initial EFH Designation 2-3
- 2.2 2008 EFH Designation Codification 2-3
- 2.3 NMFS 2011 5-Year Review of EFH for Pacific Coast Salmon 2-4

3.0 Consultation History 3-1
- 3.1 EFH Consultations for the Proposed Action 3-1
- 3.2 Key Consultation Considerations 3-5
  - 3.2.1 NMFS 2005 Biological Opinion (Yuba River Development Project License Amendment) 3-5
  - 3.2.2 NMFS 2012 Biological Opinion (Corps Operation and Maintenance of Englebright Dam and Daguerre Point Dam) 3-6
  - 3.2.3 Other Activities 3-8

4.0 Description of the Proposed Action 4-1
- 4.1 Existing Project Facilities 4-1
  - 4.1.1 New Colgate Development 4-2
  - 4.1.2 Existing Project Boundary 4-9
  - 4.1.3 Existing Project Safety 4-9
  - 4.1.4 Existing Project Operations 4-10
  - 4.1.5 Existing Environmental Measures 4-14
- 4.2 YCWA's Proposed Project 4-21
  - 4.2.1 Proposed Project Facilities 4-21
  - 4.2.2 Proposed Project Boundary 4-37
  - 4.2.3 Proposed Project Operations 4-40
  - 4.2.4 Proposed Environmental Conditions 4-40

5.0 Description of the EFH Action Area 5-1
- 5.1 NMFS Designation of EFH 5-1
- 5.2 FERC's Defined Action Area 5-5
  - 5.2.1 Adjacent Areas in the Yuba River Watershed Upstream of Englebright Dam and Reservoir 5-5
  - 5.2.2 Lower Yuba River Downstream of Englebright Dam and Reservoir 5-7
- 5.3 Other Aquatic Habitat Areas of Chinook Salmon EFH in the ESU (Downstream of the Project Area) 5-10
  - 5.3.1 Feather River 5-12

Table of Contents (continued)

Section No.	Description	Page No.
5.3.2	Sacramento River	5-12
5.3.3	Sacramento-San Joaquin Delta	5-13
5.3.4	Pacific Ocean	5-13
6.0	Species Managed under the Pacific Coast Salmon Fisheries Management Plan	6-1
6.1	Central Valley Fall-/Late Fall-run Chinook Salmon ESU	6-1
6.1.1	General Life History and Habitat Requirements	6-2
6.1.2	Historical Distribution and Abundance	6-6
6.1.3	Population Status and Trends	6-10
6.2	Limiting Factors, Threats and Stressors	6-14
6.2.1	Pacific Coast Salmon	6-15
6.2.2	Central Valley Chinook Salmon	6-17
6.2.3	Yuba River Chinook Salmon	6-20
6.3	Overview of Chinook Salmon EFH Components in the Action Area	6-20
6.3.1	Yuba River Watershed Upstream of Englebright Dam	6-21
6.3.2	Yuba River Downstream of Englebright Dam	6-21
6.4	Migratory Habitat (Adult Upstream and Juvenile Downstream)	6-22
6.4.1	Yuba River Watershed Upstream of Englebright Dam	6-23
6.4.2	Downstream of Englebright Dam	6-41
6.4.3	Spawning and Embryo Incubation Habitat	6-66
6.4.4	Juvenile Rearing Habitat	6-78
7.0	Analyses of Potential Effects of the Proposed Action on Essential Fish Habitat for Managed Species	7-1
7.1	EFH Assessment Approach	7-1
7.2	Habitat Descriptors	7-2
7.3	Summary of Existing EFH Conditions	7-3
7.3.1	Yuba River Watershed Upstream of Englebright Dam	7-3
7.3.2	Yuba River Downstream of Englebright Dam	7-10
7.4	Potential Effects of the Proposed Action on EFH in the Action Area	7-16
7.4.1	Yuba River Watershed Upstream of Englebright Dam	7-17
7.4.2	Yuba River Downstream of Englebright Dam	7-42
7.5	Past, Present, and Reasonably Foreseeable Future Actions that Potentially Affect EFH in the Action Area (Cumulative Effects)	7-55
7.5.1	Past and Present Actions	7-55
7.5.2	Reasonably Foreseeable Future Actions	7-56
7.5.3	Yuba River Watershed Upstream of Englebright Dam	7-57
7.5.4	Yuba River Downstream of Englebright Dam	7-71
8.0	Summary of Effects	8-1

Table of Contents (continued)

Section No.	Description	Page No.
8.1	Summary of Anticipated Effects of the Proposed Action on EFH in the Action Area	8-1
8.1.1	Yuba River Watershed Upstream of Englebright Dam	8-1
8.1.2	Yuba River Downstream of Englebright Dam	8-1
8.2	Summary of Anticipated Effects of the Cumulative Condition on EFH in the Action Area	8-3
8.2.1	Yuba River Watershed Upstream of Englebright Dam	8-3
8.2.2	Yuba River Downstream of Englebright Dam	8-3
9.0	Determination	9-1
10.0	References	10-1

List of Figures

Figure No.	Description	Page No.
3.2.3-1.	Yuba Accord North Yuba Water Year Type Index.	2-11
5.1-1.	Comparison of the California Central Valley 4th field HUs designated as EFH in Amendment 14 with the newly defined HUs having current or historical Chinook salmon distribution data (Modified from NMFS and PFMC 2011a; NMFS 2011).	5-4
5.2.2-1.	Map of study area showing geomorphic reach boundaries.	5-9
5.3-1.	Other EFH areas affecting Yuba River spring- and fall-run Chinook salmon throughout the ESUs.	5-11
6.4.1-1.	Mean daily water temperatures in the North Yuba River above New Bullards Bar Dam (RM 16.1) and above the Middle Yuba River confluence (RM 0.1) in Water Years 2009, 2010, 2011 and 2012.	6-29
6.4.1-2.	Mean daily water temperatures in the Middle Yuba River from Our House Diversion Dam (RM 12.7) to the North Yuba River confluence (RM 0.1) during Water Years 2009, 2010, 2011 and 2012.	6-34
6.4.1-3.	Mean daily water temperatures in the Yuba River from the Middle and North Yuba rivers downstream to above the normal-maximum water-surface elevation of the Corps' Englebright Reservoir during Water Years 2009, 2010, 2011 and 2012.	6-39
6.4.2-1.	Average location (+/- 1 standard deviation) of all acoustically-tagged Chinook salmon during 2009.	6-43
6.4.2-2.	Average location (+/- 1 standard deviation) of all acoustically-tagged Chinook salmon during 2010.	6-44
6.4.2-3.	Average location (+/- 1 standard deviation) of all acoustically-tagged Chinook salmon during 2011.	6-44
6.4.2-4.	Monitored lower Yuba River water temperatures and spring-run Chinook salmon upper tolerance water temperature index values.	6-53
6.4.2-5.	Monitored lower Yuba River water temperatures and fall-run Chinook salmon upper tolerance water temperature index values.	6-54
6.4.3-1.	Longitudinal distribution of the mean substrate diameter. The box represents the typical range of spawning substrate sizes observed on the lower Yuba River.	6-72
6.4.3-2.	Spring-run Chinook salmon spawning habitat duration over the 41-year hydrologic period for the Environmental Baseline and Without-Project scenarios.	6-76
6.4.3-3.	Fall-run Chinook salmon spawning habitat duration over the 41-year hydrologic period for the Environmental Baseline and Without-Project scenarios.	6-77
6.4.4-1.	Overview of scores by basin, stream, and indices. Sites with starred symbols represent locations where insufficient organisms were collected to make the resultant IBI and MMI scores reliable.	6-83
6.4.4-2.	Vegetation communities in the lower Yuba River vicinity.	6-90
7.4.2-1.	Spring-run Chinook salmon spawning habitat duration over the 41-year hydrologic period for the Proposed Action and Environmental Baseline scenarios.	7-44

List of Figures (continued)

Figure No.	Description	Page No.
7.4.2-2.	Fall-run Chinook salmon spawning habitat duration over the 41-year hydrologic period for the Proposed Action and Environmental Baseline scenarios.	7-45
7.5.4-1.	Spring-run Chinook salmon spawning habitat duration over the WY 1975 - 2008 hydrologic period for the Cumulative Condition and Environmental Baseline scenarios.	7-73
7.5.4-2.	Fall-run Chinook salmon spawning habitat duration over the WY 1975 - 2008 hydrologic period for the Cumulative Condition and Environmental Baseline scenarios.	7-74

List of Tables

Table No.	Description	Page No.
3.2.3-1.	Yuba Accord flow schedules.	3-10
5.1-1.	Pacific Salmon EFH Identified by USGS Hydrologic Unit Code (HUC) for the Lower Yuba River (73 FR 60987).	5-1
5.2.2-1.	Geomorphic reaches in the Yuba River downstream from Englebright Dam.	5-8
6.1.1-1.	Lifestage-specific periodicities for fall-run Chinook salmon in the lower Yuba River.	6-2
6.1.2-1.	Fall-run Chinook salmon escapement estimates from 1994-2012 for rivers in the California Central Valley (GrandTab 2013).	6-8
6.1.3-1.	Fall-run Chinook salmon abundance from 1996 through 2010 in the Sacramento River system.	6-10
6.1.3-2.	Estimated number of phenotypic spring-run and fall-run Chinook salmon spawning in the lower Yuba River from 2004 through 2011, and corresponding spring-run and fall-run Chinook salmon spawners reported in GrandTab for Sacramento River system.	6-14
6.2.1-1.	Lifestage-specific habitat concerns associated with Pacific Coast salmon EFH (PFMC 1999).	6-15
6.2.1-2.	Non-fishing threats to Pacific Coast salmon EFH. Newly identified threats appear in the right column. Detailed information on the threats identified in the first column can be found in Amendment 14.	6-16
6.4.1-1.	Length, frequency, width and depth of ground-mapped habitat units for the North Yuba River – New Bullard Bar Reach (between the junction with the Middle Yuba River and New Bullards Bar Dam). The shaded cells are characteristics of pools that do not apply to non-pool habitat types (Source: Technical Memorandum 3-10).	6-24
6.4.1-2.	Summary of ground mapped data for the North Yuba River – New Bullard Bar Reach (between the junction with the Middle Yuba River and New Bullards Bar Dam).	6-24
6.4.1-3.	Summary of minimum and maximum daily average water temperatures (°C) by month within EFH reaches in the Upper Yuba River Watershed potentially affected by the Proposed Action during Water Years 2009 through 2012. Shaded cells indicate values over 20°C (68°F).	6-27
6.4.1-4.	Length, frequency, width and depth of ground-mapped habitat units in the Middle Yuba River – Oregon Creek and Our House Diversion Dam Reaches (between the junction with North Yuba River to Our House Diversion Dam). The shaded cells are characteristics of pools that do not apply to non-pool habitat types.	6-32
6.4.1-5.	Reach summary of ground mapped data for the Middle Yuba River – Oregon Creek and Our House Diversion Dam Reaches (between the junction with North Yuba River to Our House Diversion Dam).	6-33

List of Tables (continued)

Table No.	Description	Page No.
6.4.1-6.	Length, frequency, width and depth of ground-mapped habitat units for the Mainstem Yuba River – New Colgate Powerhouse and Middle/North Yuba River Reaches (between the New Colgate Powerhouse and the Middle/North Yuba junction). The shaded cells are characteristics of pools that do not apply to non-pool habitat types.	6-37
6.4.1-7.	Summary of ground mapped data for the Mainstem Yuba River – New Colgate Powerhouse and Middle/North Yuba River Reaches (between the New Colgate Powerhouse and the Middle/North Yuba junction).	6-38
6.4.2-1.	2009 Individual Fish Movements in Relation to Changes in Smartsville Flow.	6-47
6.4.2-2.	2010 Individual Fish Movements in Relation to Changes in Smartsville Flow.	6-48
6.4.2-3.	2011 Individual Fish Movements in Relation to Changes in Smartsville Flow.	6-49
6.4.2-4.	Spring-run Chinook salmon lifestage-specific upper tolerance water temperature index values.	6-52
6.4.2-5.	Fall-run Chinook salmon lifestage-specific upper tolerance water temperature index values.	6-52
6.4.2-6.	Environmental Baseline modeled water temperature exceedances for spring-run Chinook salmon lifestage- and location-specific periodicities in the lower Yuba River at Smartsville (SMRT), below Daguerre Point Dam (DPD), and Marysville (MRY).	6-56
6.4.2-7.	Environmental Baseline modeled water temperature exceedances[1] for fall-run Chinook salmon lifestage- and location-specific periodicities in the lower Yuba River at Smartsville, Daguerre Point Dam, and Marysville.	6-57
6.4.2-8.	Without-Project modeled water temperature exceedances[1] for spring-run Chinook salmon lifestage- and location-specific periodicities in the lower Yuba River at Smartsville, below Daguerre Point Dam, and Marysville.	6-59
6.4.2-9.	Without-Project modeled water temperature exceedances[1] for fall-run Chinook salmon lifestage- and location-specific periodicities in the lower Yuba River at Smartsville, Daguerre Point Dam, and Marysville.	6-60
6.4.2-10.	Difference in simulated water temperature exceedance probabilities for spring-run Chinook salmon lifestages under the Environmental Baseline, relative to the Without-Project scenario.	6-61
6.4.2-11.	Difference in simulated water temperature exceedance probabilities for fall-run Chinook salmon lifestages under the Environmental Baseline, relative to the Without-Project scenario.	6-61
6.4.3-1.	Long-term and Water Year Type Average Spring-run Chinook Salmon Spawning WUA (Percent of Maximum) under the Environmental Baseline and Without Project Scenarios.	6-75
6.4.3-2.	Long-term and Water Year Type Average Fall-run Chinook Salmon Spawning WUA (Percent of Maximum) under the Environmental Baseline and Without Project Scenarios.	6-77

List of Tables (continued)

Table No.	Description	Page No.
7.3.2-1.	Chinook salmon stressors and associated magnitudes in the lower Yuba River under the Environmental Baseline.	7-11
7.4.1-1.	Comparison of simulated mean monthly water temperatures in the North Yuba River upstream of the Middle Yuba River Confluence under the No Action Alternative (existing conditions) and the Proposed Project Alternative (Proposed Action) for water years 1970 through 2010.	7-19
7.4.1-2.	Summary of North Yuba River water quality data downstream of New Bullards Bar Reservoir (see Technical Memorandum 2-3 for complete results).	7-21
7.4.1-3.	Comparison of Simulated Mean Monthly Water Temperatures in the Middle Yuba River upstream of the North Yuba River (Our House Diversion Dam Reach), for the No Action Alternative and Proposed Project Alternative, for Water Years 1970 through 2010.	7-26
7.4.1-4.	Summary of Middle Yuba River water quality data (see Technical Memorandum 2-3 for complete results).	7-30
7.4.1-5.	Mean monthly flows (cfs) in the North Yuba/Middle Yuba River Reach for the Yuba River Index water year types from Water Year 1970 through Water Year 2010.	7-34
7.4.1-6.	Mean monthly flows (cfs) downstream of the New Colgate Powerhouse for the Yuba River Index water year types from Water Year 1970 through Water Year 2010.	7-34
7.4.1-7.	Comparison of Simulated Mean Monthly Water in the Yuba River downstream of the Middle Yuba and North Yuba River confluence, for the No Action Alternative (existing conditions) and Proposed Project Alternative (Proposed Action), for Water Years 1970 through 2010.	7-36
7.4.1-8.	Comparison of Simulated Mean Monthly Water Temperatures in the Yuba River downstream of the New Colgate Powerhouse (New Colgate Powerhouse Reach), for the No Action Alternative and Proposed Project Alternative, for Water Years 1970 through 2010.	7-36
7.4.1-9.	Summary of Yuba River Upstream of Englebright Dam water quality data (see Technical Memorandum 2-3 for complete results).	7-39
7.4.2-1.	Conference year flow requirements at Marysville.	7-43
7.4.2-2.	Long-term and water year type average spring-run Chinook salmon spawning WUA (percent of maximum) under the Proposed Action and Environmental Baseline scenarios.	7-43
7.4.2-3.	Long-term and water year type average fall-run Chinook salmon spawning WUA (percent of maximum) under the Proposed Action and Environmental Baseline scenarios.	7-45
7.4.2-4.	Proposed Action modeled water temperature exceedances for spring-run Chinook salmon lifestage- and location-specific periodicities in the lower Yuba River at Smartsville (SMRT), below Daguerre Point Dam (DPD), and Marysville (MRY).	7-47

List of Tables (continued)

Table No.	Description	Page No.
7.4.2-5.	Proposed Action modeled water temperature exceedances[1] for fall-run Chinook salmon lifestage- and location-specific periodicities in the lower Yuba River at Smartsville, Daguerre Point Dam, and Marysville.	7-48
7.4.2-6.	Difference in simulated water temperature exceedance probabilities for spring-run Chinook salmon lifestages under the Proposed Action relative to the Environmental Baseline.	7-50
7.4.2-7.	Difference in simulated water temperature exceedance probabilities for fall-run Chinook salmon lifestages under the Proposed Action scenario relative to the Environmental Baseline scenario.	7-51
7.4.2-8.	Difference in simulated water temperature exceedance probabilities for spring-run Chinook salmon lifestages under the Proposed Action, relative to the Without Project scenario.	7-52
7.4.2-9.	Difference in simulated water temperature exceedance probabilities for fall-run Chinook salmon lifestages under the Proposed Action, relative to the Without Project scenario.	7-53
7.5.3-1.	Long-term average flow and average flow by water year type in the New Bullards Bar Dam Reach of the North Yuba River under the Cumulative Condition, relative to the existing condition.	7-59
7.5.3-2.	Long-term average water temperature and average water temperature by water year type in the New Bullards Bar Dam Reach of the North Yuba River under the Cumulative Condition, relative to the existing condition.	7-60
7.5.3-3.	Long-term average flow and average flow by water year type in the Middle Yuba River above the confluence with the North Yuba River under the Cumulative Condition, relative to the existing condition.	7-63
7.5.3-4	Long-term average water temperature and average water temperature by water year type in the Middle Yuba River above the confluence with the North Yuba River under the Cumulative Condition, relative to the existing condition.	7-65
7.5.3-5.	Long-term average flow and average flow by water year type in the Yuba River below the New Colgate Powerhouse under the Cumulative Condition, relative to the existing condition.	7-68
7.5.3-6.	Long-term average water temperature and average water temperature by water year type in the Yuba River below New Colgate Powerhouse under the Cumulative Condition, relative to the existing condition.	7-70
7.5.4-1.	Long-term and water year type average spring-run Chinook salmon spawning WUA (percent of maximum) under the Cumulative Condition and Environmental Baseline scenarios.	7-72
7.5.4-2.	Long-term and water year type average fall-run Chinook salmon spawning WUA (percent of maximum) under the Cumulative Condition scenario and Environmental Baseline scenario (existing conditions).	7-74
7.5.4-3.	Cumulative Condition modeled water temperature exceedances for spring-run Chinook salmon lifestage- and location-specific periodicities in the Yuba River at Smartsville (SMRT), below Daguerre Point Dam (DPD), and Marysville (MRY).	7-76

List of Tables (continued)

Table No.	Description	Page No.
7.5.4-4.	Cumulative Condition modeled water temperature exceedances for fall-run Chinook salmon lifestage- and location-specific periodicities in the Yuba River at Smartsville, below Daguerre Point Dam, and Marysville.	7-78
7.5.4-5.	Difference in simulated water temperature exceedance probabilities for spring-run Chinook salmon lifestages under the Cumulative Condition relative to the Environmental Baseline.	7-79
7.5.4-6.	Difference in simulated water temperature exceedance probabilities for fall-run Chinook salmon lifestages under the Cumulative Condition relative to the Environmental Baseline.	7-80

List of Attachments

Attachment A YCWA's Proposed Conditions

GLOSSARY – DEFINITIONS OF TERMS, ACRONYMS AND ABBREVIATIONS

ac	acre
ac-ft	acre-feet
Applicant-Prepared Draft BA	YCWA's Applicant-Prepared Draft Biological Assessment included in Volume V of YCWA's Application for New License.
Applicant-Prepared Draft EFH	YCWA's Applicant-Prepared Draft Essential Fish Habitat Assessment included in Volume V of YCWA's Application for New License.
BA	biological assessment
Cal Fish and Wildlife, or CDFW	California Department of Fish and Wildlife, formally CDFG
CDFG	California Department of Fish and Game, now Cal Fish and Wildlife
CDEC	California Data Exchange Center
cfs	cubic feet per second
Corps	United States Army Corps of Engineers
DWR	California Department of Water Resources
EFH	Essential Fish Habitat as determined by NMFS for salmon
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
Forest Service	United States Department of Agriculture, Forest Service
ft	feet
Licensee	Yuba County Water Agency
mi	mile
NFS	National Forest System
NMFS	United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service
PG&E	Pacific Gas and Electric Company
PNF	Plumas National Forest
Project	Yuba River Development Project, FERC Project No. 2246
sq mi	square mile
TNF	Tahoe National Forest
USACE	United States Army Corps of Engineers
USFWS	United States Department of Interior, Fish and Wildlife Service
USGS	United States Geological Survey
YCWA	Yuba County Water Agency

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SECTION 1.0
INTRODUCTION

This Applicant-Prepared Draft Essential Fish Habitat (EFH) assessment has been prepared pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (16 U.S.C. §§ 1801-1891d). This EFH assessment defines and evaluates the potential effects of the Federal Energy Regulatory Commission's (FERC or Commission) issuance of a new license to the Yuba County Water Agency (YCWA or Licensee) for the operation of the Yuba River Development Project (Project), FERC Project No. 2246, (Project), on lower Yuba River Chinook salmon (*Oncorhynchus tshawytscha)* that are Federally managed under the MSFCMA and on their designated EFH. Pursuant to Section 305(b) of the MSFCMA (16 U.S.C. §1855(b)), and the United States Department of Commerce (USDOC), National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) implementing regulation (50 C.F.R. § 600.920), YCWA has prepared this Applicant-Prepared Draft EFH assessment.

The MSFCMA establishes jurisdiction over marine fisheries in the United States' exclusive economic zone (3 to 200 nautical miles offshore) through establishment of Regional Fisheries Management Councils (Councils) that develop Fishery Management Plans (FMP). The FMPs address fishery management and conservation issues, including designating EFH to conserve and enhance species managed under FMPs. The Pacific Fisheries Management Council (PFMC) manages all species of Pacific Coast salmon pursuant to the Pacific Coast Salmon FMP, which includes the management of Chinook salmon in California.1 In the Mid-Pacific Region, the PFMC designates EFH and NMFS approves the designation. EFH only applies to commercial fisheries, including all runs (spring-run and fall/late fall-run) of Chinook salmon (*Oncorhynchus tshawytscha*) in the Yuba River.

During the National Environmental Policy Act (NEPA) scoping for relicensing of the YCWA Project, issues were raised regarding potential Project effects on Chinook salmon and its habitat in the Yuba River. As described in the April 2011 Scoping Document 2 for the Yuba River Hydroelectric Project, California, Project No. 2246-058, NMFS suggested the following scope for EFH:

- Upstream Extent of EFH - The potential action area extends throughout the upper Yuba watershed, including the North, Middle, and South Yuba watersheds.
- Downstream Extent of EFH - The potential action area includes the lower Yuba River watershed to the confluence of the Feather River, the lower Feather River, the lower Sacramento River, and through the Sacramento-San Joaquin Delta to San Francisco Bay.

The FERC's April 2011 scoping document includes anadromous fish and EFH as potentially cumulatively affected resources.

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[1] In California, the Pacific Coast salmon Fishery Management Plan (FMP) does not distinguish between the four races of Chinook salmon species (i.e., winter-, spring-, fall- and late-fall-run Chinook salmon).

There currently are no anadromous fish in the Yuba River Basin upstream of Englebright Dam. However, actions occurring upstream of Englebright Dam, including proposed Project actions, have the potential to affect designated EFH upstream of Englebright Dam, and to contribute to potential effects on anadromous fish and EFH downstream of Englebright Dam.

Actions throughout the Yuba River Basin and downstream to San Francisco Bay, including proposed Project actions, have the potential to affect the numbers of juveniles and smolts that are produced and survive outward emigration and returning adults to the Yuba River, and the conditions of those individuals. The recommended geographic scope in the April 2011 scoping document was included in this Applicant-Prepared Draft EFH assessment to the extent necessary to understand potential effects on Chinook salmon and designated EFH, and how the Project would contribute to those effects.

Even though the potential Project-specific effects on EFH are restricted to the habitats that are directly or indirectly affected by the Project – both upstream and downstream of Englebright Dam – other actions upstream and downstream of Englebright Dam have the potential to affect the quality of EFH throughout the geographic scope suggested in the April 2011 scoping document. Understanding the effects of those potential actions allows this Applicant-Prepared Draft EFH assessment to place Project-specific effects on EFH in their proper perspective. This expanded scope does not imply that Project-related effects extend beyond the Yuba River Basin.

The Biological Assessment (BA) for the Proposed Action thoroughly discussed the status of Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*), which are listed as a threatened species under the Endangered Species Act (ESA) and the potential effects of the Proposed Action on this species. That BA also discussed the critical habitat utilized by spring-run Chinook salmon that potentially would be affected by the Proposed Action and these potential effects. Therefore, this Applicant-Prepared Draft EFH assessment primarily concentrates on EFH for the Central Valley fall/late fall-run Chinook salmon Evolutionarily Significant Unit (ESU), which also is covered under the MSFCMA, although it is not listed as a threatened or endangered species under the ESA.

From a broad perspective, EFH includes the geographic areas where a species occurs at any time during its life cycle, and these areas may be described in terms of ecological characteristics, location, and time (Hanson et al. 2004). Ecologically, EFH includes waters and substrates that focus distribution (e.g., migration corridors, spawning areas, rocky reefs, intertidal salt marshes, or submerged aquatic vegetation) and other characteristics that are less distinct (e.g., turbidity zones, salinity gradients). Spatially, habitats and their uses may shift over time due to climate change, human activities, geologic events, and other circumstances. The type of habitats available, their attributes, and their functions are important to a species' (e.g., Chinook salmon) productivity, diversity, health, and survival (Hanson et al. 2004).

While Section 7 ESA provisions are intended to prevent jeopardy or adverse modification of critical habitat, EFH provisions are intended to ensure a sustainable fishery. Originally enacted in 1976, the MSFCMA has been amended several times. In 1996, the Sustainable Fisheries Act amended the MSFCMA by adding provisions intended to end overfishing and rebuild overfished fisheries, reduce bycatch, and assess and minimize the impacts of management measures on fishing communities (73 FR 60987). Congress articulated in its findings that one of the greatest long-term threats to the viability of commercial and recreational fisheries is the continuing loss of marine, estuarine, and other aquatic habitats (73 FR 60987). Congress found that habitat considerations should receive increased attention for the conservation and management of fishery resources of the United States (16 U.S.C. § 1801(a)(9)). In making such findings, Congress declared one of the purposes of the MSFCMA is the promotion of ''*…the protection of [EFH] in the review of projects conducted under Federal permits, licenses, or other authorities that affect or have the potential to affect such habitat*'' (16 U.S.C. § 1801(b)(7)). To ensure that habitat considerations receive increased attention for the conservation and management of fishery resources, the MSFCMA requires each existing, and any new, FMP to: (1) describe and identify EFH; (2) minimize to the extent practicable adverse effects on such habitat caused by fishing; and (3) identify other actions to encourage the conservation and enhancement of such habitat (16 U.S.C. § 1853(a)(7)).

The objective of this Applicant-Prepared Draft EFH assessment is to determine whether the Proposed Action would adversely affect designated Chinook salmon EFH. If necessary, this assessment also will develop proposed conservation measures to avoid, minimize, or otherwise offset potential adverse effects to designated EFH resulting from the Proposed Action. This Applicant-Prepared Draft EFH assessment only considers EFH for Pacific salmon because the Action Area for the Proposed Action does not extend into areas of EFH for groundfish or coastal pelagic species.

1.1 Purpose of the Essential Fish Habitat Assessment

The MSFCMA requires Federal agencies like FERC to consult with NMFS on any action that the Federal agency funds, authorizes, or undertakes, or proposes to fund, authorize, or undertake, and that may adversely affect EFH (16 U.S.C. § 1855(b)(2)). In California, there are three FMPs addressing: 1) groundfish; 2) coastal pelagic species; and 3) Pacific salmon (see 50 C.F.R., pt. 660). Federal agencies must consider the effects of a proposed action on all three types of EFH, as applicable. EFH regulations state that consultations are required of Federal action agencies for renewals, reviews, or substantial revisions of actions if the renewal, review, or revision may adversely affect EFH (50 C.F.R. § 600.920(a)(1)). Federal action agencies required to consult with NMFS on EFH issues must provide NMFS with a written assessment of the effects of their action on EFH (50 C.F.R. § 600.920(e)(1)). Additionally, this Applicant-Prepared Draft EFH assessment follows the EFH regulations regarding EFH coordination, consultation, and recommendations (50 C.F.R. §§ 600.905-600.930).

This Applicant-Prepared Draft EFH assessment describes the relationship between the relicensing of the Project and Chinook salmon EFH in the vicinity of the Project, and evaluates the potential effect of the Proposed Action (i.e., FERC's issuance of a new license for the Project) on Chinook salmon and on their designated EFH. An EFH assessment is a necessary component for efficient and effective consultations between a Federal agency and NMFS. This Applicant-Prepared Draft EFH assessment provides the basis upon which consultation under the MSFCMA will be conducted between FERC and the USDOC, acting through NMFS.

1.2 Regulatory Framework

1.2.1 Magnuson-Stevens Fishery Conservation and Management Act (16 USC §1801-1891d)

The purposes of the MSFCMA are to: 1) take immediate action to conserve and manage fishery resources off the U.S.'s coasts; 2) support the implementation and enforcement of international fishery agreements for the conservation and management of highly migratory species; 3) promote domestic commercial and recreational fishing under sound conservation and management principles; 4) provide for preparation and implementation of fishery management plans to achieve and maintain the optimum yield of each fishery on a continuing basis; 5) establish Councils to protect fishery resources through preparation, monitoring, and revision of plans that allow for the participation of States, tribes, the fishing industry, and consumer and environmental organizations; 6) encourage the development of underutilized U.S. fisheries; and 7) promote the protection of EFH (16 U.S.C. § 1801(b)). Consultation with NMFS is required when any action authorized, funded, undertaken, or proposed to be authorized, funded, or undertaken may adversely affect any EFH (16 U.S.C. § 1855(b)(2)).

Federal agencies must consult with the NMFS on their activities that may adversely affect EFH, regardless of whether or not those activities occur within designated EFH. In other words, an activity can adversely affect EFH without occurring within EFH (NMFS 2011).

An MSFCMA regulation provides that FMPs should identify specific types or areas of habitat within EFH as "*habitat areas of particular concern*" (HAPC) based on one or more of the following considerations: 1) the importance of the ecological function provided by the habitat; 2) the extent to which the habitat is sensitive to human-induced environmental degradation; 3) whether, and to what extent, development activities are, or will be, stressing the habitat type; and 4) the rarity of the habitat type (50 C.F.R. § 600.815(a)(8)). The intended goal of identifying such habitats as HAPCs is to provide additional focus for conservation efforts. While the HAPC designation does not add any specific regulatory process, it highlights certain habitat types that are of high ecological importance. This designation is manifested in EFH consultations, in which NMFS can call attention to a HAPC and recommend that the Federal action agency make an extra effort to protect these important habitats (NMFS and PFMC 2011).

Amendment 14 discussed HAPCs for each species but did not establish HAPCs, citing lack of sufficient data on which to base HAPCs. Similar to EFH in general, HAPCs are subject to periodic reviews and are therefore subject to modification over time (NMFS and PFMC 2011). As part of the 5-year review, NMFS and PFMC (2011) developed five potential HAPCs for Pacific Coast salmon, which are: 1) complex channels and floodplain habitats; 2) thermal refugia; 3) spawning habitat; 4) estuaries; and 5) marine and estuarine submerged aquatic vegetation.

Fishery management councils and NMFS also should identify non-fishing activities that may adversely affect EFH, and actions to encourage the conservation and enhancement of EFH, including recommended options to avoid, minimize, or compensate for the adverse effects identified in the FMP. Amendment 14 included 21 activities and conservation measures. Since Amendment 14 was published, 10 additional non-fishing threats to EFH have gained attention, and include climate change, flood control maintenance, over-water structures, pile driving, and pesticide use, among others (NMFS and PFMC 2011). Although recommended conservation measures have not yet been identified for the 10 newly-identified threats, NMFS and PFMC (2011) anticipate that if the PFMC amends the Pacific Coast Salmon FMP, the descriptions of all 31 threats will be expanded upon and refined, and that conservation measures will be developed for each threat.

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SECTION 2.0
ESSENTIAL FISH HABITAT BACKGROUND

As discussed above, the MSFCMA requires the development of FMPS for marine fisheries in the United States' exclusive economic zone. The MSFCMA established Councils to improve fisheries management and conservation, and authorized them to prepare and implement FMPs for fisheries under their jurisdiction.

The Sustainable Fisheries Act of 1996 amended the MSFCMA to further address fishery management and conservation issues including overfishing, bycatch, and protection of fish habitats.

NMFS issued final regulations pertaining to implementation of the EFH provisions of the MSFCMA on January 17, 2002 (50 C.F.R., pt. 600). These regulations contain guidelines to assist the Councils and NMFS in identifying EFH in FMPs, identifying adverse effects to EFH, and identifying actions necessary to conserve and enhance EFH (50 C.F.R. §§ 600.805-600.815).

The MSFCMA defines Essential Fish Habitat as *"those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity"* (16 U.S.C. § 1802(10)). In its definition of EFH, a NMFS regulation defines several EFH terms as follows (50 C.F.R. § 600.10):

- "*Waters*" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate.
- "*Substrate*" includes sediment, hard bottom, structures underlying the waters, and associated biological communities.
- "*Necessary*" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem.
- "*Spawning, breeding, feeding, or growth to maturity*" covers a species' full life cycle.

Under the MSFCMA, EFH consultation is required for any Federal agency action that may adversely affect EFH, including actions that occur outside of designated EFH. The consultation required includes the following provisions (16 U.S.C. §1855(b); 50 C.F.R. § 600.920):

- Federal agencies must consult with the Secretary of Commerce, through NMFS.
- The Secretary of Commerce, through NMFS, must provide conservation recommendations to any Federal or State agency if the agency's action may adversely affect EFH.
- Councils may comment on and make recommendations to the Secretary of Commerce and any Federal or State agency concerning any Federal or State agency action that may affect that

habitat, including EFH, of a fishery resource under its authority. In addition, the Councils must make such recommendations if in their view an activity is likely to substantially affect the habitat, including EFH of an anadromous fishery resource under Council authority.

- Federal agencies must provide a detailed response in writing to the Secretary of Commerce, through NMFS, within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the NMFS' EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations.

NMFS defines an *"adverse effect"* to EFH as any impact which reduces the quality and/or quantity of EFH, and may include *"direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH"* (50 C.F.R. § 600.910(a)).

In October 2008, NMFS promulgated additional regulations specifically related to the identification of EFH for Pacific salmon (50 C.F.R. pt. 660, subpt. H). Chinook salmon EFH was defined to include "*all streams, estuaries, marine waters, and other water bodies occupied or historically accessible to Chinook salmon*…" within specified United States Geological Survey (USGS) hydrologic units, which includes the lower Yuba River (50 C.F.R. § 660.412(a) & pt. 660, subpt. H, table 1).

As required by the MSFCMA, PFMC (1999) identified and described EFH, and identified adverse impacts and recommended conservation measures for salmon in Amendment 14 to the Pacific Coast Salmon FMP. The EFH for the Pacific Coast salmon fishery is defined as those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem (PFMC 1999).

The Action Area for the Proposed Action is within the area identified as EFH for Pacific Coast salmon species identified in Amendment 14 of the Pacific Coast Salmon FMP (PFMC 1999). Chinook salmon (*O. tshawytscha*) are the largest of the Pacific salmon, and are highly prized by commercial, sport, and subsistence fishers (NMFS 2009a). Pacific Coast Chinook salmon stocks are managed by the PFMC under the Pacific Salmon FMP, and these stocks primarily include fall- and late fall-run Chinook salmon from the Central Valley system (NMFS 2009a).

According to NMFS and PFMC (2011), Chinook salmon (*Oncorhynchus tshawytscha*) EFH, as currently designated, includes all streams, estuaries, marine waters, and other waterbodies occupied or historically accessible to Chinook salmon in Washington, Oregon, Idaho, and California. Exceptions include cases in which long-standing naturally occurring barriers (e.g., natural waterfalls in existence for several hundred years) or specifically identified man-made barriers (e.g., dams) represent the current upstream extent of Pacific salmon access (PFMC 1999). Chinook salmon EFH includes the marine areas off Alaska designated as salmon EFH by the North Pacific Fishery Management Council (NPFMC). Including marine EFH designated by the NPFMC serves to recognize the migratory patterns of Chinook salmon, and the importance of habitat during all life stages. Current marine EFH for Chinook salmon includes the entire exclusive economic zone (EEZ) around Alaska. The southern extent of Chinook salmon marine EFH extends to Point Conception, California, which represents the approximate southern extent of the Chinook salmon range. Important elements of Chinook salmon marine EFH include juvenile and adult migration, estuarine rearing, and ocean rearing. Key features of estuarine and marine habitats include:

- Water Quality
- Depth, Cover, Marine Vegetation, and Algae in Estuarine and Near-Shore Habitats
- Water Temperature
- Prey Species and Forage Base (Food)

Overall, Chinook salmon marine distribution is extensive, varies seasonally and inter-annually, and can only be defined generally (PFMC 1999).

Freshwater EFH for Pacific Coast salmon in the Central Valley includes waters currently or historically accessible to salmon within the Central Valley ecosystem as described in Myers et al. (1998). EFH includes not only the watersheds of the Sacramento and San Joaquin River basins but also the San Joaquin Delta (Delta) hydrologic unit (i.e., HUC No. 18040003), Suisun Bay hydrologic unit (HUC No. 18050001) and the lower Sacramento hydrologic unit (HUC No. 18020109). Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley fall- and late fall-run Chinook salmon are species managed under the Pacific Coast Salmon FMP that occur in the Central Valley, as well as the Delta, Suisun Bay, and lower Sacramento hydrologic units.

2.1 1999 Initial EFH Designation

In 1999, the PFMC identified EFH for Central Valley Chinook salmon stocks to include the Sacramento and San Joaquin rivers and their tributaries as EFH. Freshwater EFH for Chinook salmon consists of four major habitat functions: (1) adult migration corridors and adult holding habitat; (2) spawning and incubation; (3) juvenile rearing; and (4) juvenile migration corridors (PFMC 1999). Important features of EFH for spawning, rearing and migration include:

- Access and Passage
- Water Quantity, Depth and Velocity
- Channel Gradient and Stability
- Cover and Habitat Complexity (e.g., large woody material, pools, channel complexity, aquatic vegetation)
- Substrate Composition
- Floodplain and Habitat Connectivity
- Space
- Prey Species and Forage Base (Food)
- Water Quality (e.g., dissolved oxygen, nutrients, water temperature)

2.2 2008 EFH Designation Codification

In October 2008, NMFS promulgated additional regulations specifically related to the identification of EFH for Pacific salmon (73 FR 60987). Chinook salmon EFH was defined to include "*all streams, estuaries, marine waters, and other water bodies occupied or historically accessible to Chinook salmon*…" within specified USGS hydrologic units, which include the Yuba River (50 C.F.R. § 660.412(a) & pt. 660, subpt. H, table 1).

The MSFCM requires regional fishery management councils and NMFS to periodically review the EFH provisions of FMPs, and to revise or amend EFH provisions as warranted, based on available information (50 C.F.R. § 600.815(a)(10)). Reviews should be conducted periodically, and complete reviews should be conducted at least once every five years. Pacific Coast salmon EFH was first designated in 1999 as part of Amendment 14 to the Pacific Coast Salmon FMP, and was codified in 2008 as a result of litigation (*Idaho County et al. v. Evans et al*., United States District Court for the District of Idaho, Case No. CV02-80-CEJL). Although the 2008 codification process addressed some issues (78 FR 60987), it did not constitute a full review (NMFS 2010).

2.3 NMFS 2011 5-Year Review of EFH for Pacific Coast Salmon

In March 2011, NMFS and PFMC (2011) released a report titled *Pacific Coast Salmon 5-Year Review of Essential Fish Habitat Final Report to the Pacific Fishery Management Council*, which described the findings from the latest five-year review, as summarized below.

- A summary of existing designations of EFH for Pacific Coast salmon
- Currently available information on the distribution of Pacific Coast salmon in both fresh and marine waters
- Potential changes to the existing EFH designations
- Potential changes to the list of impassible dams that currently form the upstream extent of EFH
- A discussion regarding whether appropriate models exist to predict salmon distribution where data on distribution are lacking
- A discussion of potential Habitat Areas of Particular Concern
- A summary of new information on the life history and habitat requirements of salmon
- Updated information on threats to EFH both from fishing and non-fishing activities
- Identification of research needs to further refine EFH

SECTION 3.0
CONSULTATION HISTORY

If a Federal action agency determines that a proposed action may have an adverse effect on EFH, consultation is required. Activities proposed to occur in EFH areas do not automatically require consultation. Consultations are triggered only when the proposed action may adversely affect EFH, and then, only Federal actions require consultation (Hanson et al. 2004). There are four components of an EFH consultation, which are:

- Notification. The Federal action agency (e.g., FERC) notifies NMFS of an activity that may adversely affect EFH.
- Essential Fish Habitat Assessment. The Federal action agency provides the Secretary of Commerce (through NMFS) with a description of the proposed action, analysis of effects, and effect determination.
- Conservation Recommendations. NMFS involves the Federal action agency in development of advisory EFH conservation recommendations and provides them to the Federal agency.
    - The Fishery Management Councils (through NMFS) also may comment on and make recommendations to the Secretary of Commerce and any Federal agency concerning any Federal agency action that may affect that habitat, including EFH, of a fishery resource under its authority. In addition, the Council must make such recommendations, if in its view, an activity is likely to substantially affect the habitat, including EFH of an anadromous fishery resource under Council authority.
- Federal Action Agency Response. The Federal action agency that receives the EFH conservation recommendations provides a written response to NMFS within 30 days after receiving NMFS conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the NMFS' EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (16 U.S.C. § 1855(b)(4)(B)).

3.1 EFH Consultations for the Proposed Action

Wherever possible, NMFS utilizes existing interagency coordination processes to fulfill EFH consultations with Federal agencies. Specific coordination activities that YCWA has previously conducted with NMFS are described below. Some of the meetings in which NMFS staff participated are listed below.[2]

[2] YCWA based this list on sign-in sheets form each meeting. Therefore, the list does not include NMFS staff that participated in the meeting but did not sign in.

- July 15, 2009. Larry Thompson (NMFS) was present for YCWA's initial meeting between agencies and non-governmental organizations (NGOs) to describe the Project, relicensing plan, process and items suggested by Foothill Water Network (FWN).
- August 31, 2009. Larry Thompson (NMFS) was present for the communication guidelines meeting held by YCWA where agencies and NGOs agreed to meet to discuss relicensing communication guidelines.
- October 1, 2009. YCWA offered a Project Tour to familiarize agencies, tribes and NGOs with the Project on the ground. Larry Thompson (NMFS) was present for the tour.
- May 24, 2010. Rick Wantuck (NMFS) attended the third study proposal development meeting regarding anadromous fishes, ESA/CESA Species & Non-ESA-listed fish below Englebright.
- May 4, 2011. Larry Thompson and John Wooster (NMFS) participated by phone in the Relicensing Participants meeting regarding the new studies proposed by USFWS and FWN.
- May 11, 2011. Larry Thompson and John Wooster (NMFS) attended the Relicensing Participants Meeting regarding FERC required proposed study plan meeting.
- May 19, 2011. Section 7 Consultation Meeting. The following NMFS representatives participated in this meeting: Maria Rea, Rod McInnis, Rick Wantuck, Larry Thompson, Howard Brown, Steve Edmondson, and Gary Sprague.
- June 3, 2011. John Wooster (NMFS) was present for the Relicensing Participants Meeting to continue the May 11, 2011 discussion of channel morphology study proposals.
- June 17, 2011. Larry Thompson, Rick Wantuck, and John Wooster (NMFS) participated in the Relicensing Participants Meeting to discuss NMFS' Study Requests and FWN's Anadromous Fish Passage Study Request.
- July 21, 2011. NMFS was not present for the NMFS / FERC / YCWA Section 7 Informal Consultation Meeting.
- July 27, 2011. Larry Thompson and John Wooster (NMFS) participated in the Relicensing Participants meeting regarding the general Lower Yuba River 2-D Hydraulic Model.
- August 5, 2011. NMFS/FERC/YCWA Section 7 Informal Consultation Meeting.
- August 12, 2011. NMFS/FERC/YCWA Section 7 Informal Consultation Meeting.
- October 20, 2011. NMFS filed with FERC a dispute regarding the Commission's determination. NMFS identified as "in dispute" seven studies that were requested by NMFS and not adopted by the Commission in its determination. Each of the studies included "elements," which were in effect separate studies. In total, the seven studies included 54 elements. The NMFS-requested studies in dispute were: 1) Effects of the Project and Related Activities of Fish Passage for Anadromous Fish (12 elements); 2) Effects of the Project and Related Activities on Fish Passage for Anadromous Fish (12

elements); 3) Effects of the Project and Related Activities on Water Temperature for Anadromous Fish (3 elements); 4) Effects of the Project and Related Activities on Coarse Substrate for Anadromous fish (6 elements); 5) Effects of the Project and Related Activities on Large Wood and Riparian Habitat for Anadromous Fish (4 elements); 6) Effects of the Project and Related Activities on the Loss of Marine-Derived Nutrients in the Yuba River (7 elements) and 7) Anadromous Fish Ecosystems Effects (14 elements).

- November 23, 2011. Licensee filed with FERC Study 6.1, Riparian Habitat Upstream of Englebright Reservoir Study Large Woody Debris Survey Sites in response to NMFS' October 20, 2011 notice to initiate a formal study dispute resolution process regarding FERC's Determination.
- December 13, 2011. YCWA and NMFS participated in a conference call with FERC in an effort to resolve some of the NMFS' disputes.
- March 21, 2012. Licensee held a follow-up conference call with FERC, NMFS, USFWS, Cal Fish and Wildlife and SWRCB and believed that general agreement on the approach to study 7-11, Narrows 2 Fish Behavior, was reached.
- April 17, 2012. Licensee provided the draft modified Study 7-11, Narrows 2 Fish Behavior and provided to the United States Army Corps of Engineers (Corps), USFWS, NMFS, Cal Fish and Wildlife, and the SWRCB for 30-day review and comment. CDFG provided written comments in an email dated May 15, 2012. SWRCB provided comments on May 17, 2012. NMFS did not provide written comments to the Licensee, but filed a letter with FERC dated May 25, 2012 which included comments on the Study. Corps and USFWS did not provide written comments.
- June 1, 2012. Licensee filed with FERC the Modified Study 7.11, Fish Behavior and Hydraulics Near Narrows 2 Powerhouse and included the Lower Yuba River Accord Planning Team Acoustic Telemetry Annual Report 2009, License's request for comments on the draft modified Study; written comments received from Cal Fish and Wildlife, SWRCB, and NMFS, and YCWA's reply to the written comments.
- June 14, 2012. Tom Holley, Hydrologist and Larry Thompson (NMFS) were present for the Relicensing Participants Meeting to discuss the Study 2.2, Water Balance/Operations Model - Consultation Meetings.
- December 12, 2013. Licensee held an Initial Study Report meeting for the Yuba River Development Project at their office in Marysville, California.
- January 8, 2013. John Wooster (NMFS) was present for the Relicensing Participants Meeting to discuss consultation for Study 6.1, Riparian Habitat Above Englebright and Study 6.2, Riparian Habitat Below Englebright.
- January 28, 2013. Close of the comment period for the Licensee's Initial Study Report and meeting summary. Seven letters were filed with FERC by the deadline. Letters were received from: 1) Forest Service; 2) National Park Service; 3) USFWS; 4) NMFS; 5) Cal Fish and Wildlife; and 6) Foothills Water Network.

- January 30, 2013. John Wooster (NFS) was present for the Relicensing Participants meeting to discuss consultation for Study 1.1, Channel Morpohology Above Englebright and Study 2.3, Water Quality.
- April 17, 2013. Licensee provided the Draft Study Plan 7-13, Fish Stranding Associated with the Shutdown of Narrows 2 Powerhouse Partial Bypass to the NMFS, USFWS and Cal Fish and Wildlife. Licensee did not receive written comments from NMFS, USFWS and Cal Fish and Wildlife by May 7, 2013. Licensee confirmed with NMFS, USFWS and Cal Fish and Wildlife that each agency did not have any comments on the draft study plan.
- July 3, 2013. Licensee provided Draft Study 7-11a, Radio Telemetry Study of Spring- and Fall-run Chinook Salmon Migratory Behavior Downstream of Narrows 2 Powerhouse to NMFS, USFWS, and Cal Fish and Wildlife for review and written comment. Licensee received written comments from NMFS and USFWS.
- August 14, 2013. Licensee filed with FERC the Transmittal of Plan for Study 7.11a, Radio Telemetry Study of Spring- and Fall-run Chinook Salmon Migratory Behavior Downstream of Narrows 2 Powerhouse and include written comments from NMFS and USFWS.
- September 20, 2013. Licensee filed with FERC additional work to be performed for Study 3.8, Stream Fish Populations Upstream of Englebright Reservoir and Study 3.11, Entrainment. The following Relicensing Participants agreed with additional work at the September 16, 2013 meeting: Forest Service, USFWS, SWRCB, Cal Fish and Wildlife, Foothills Water Network and the South Yuba River Citizens League.
- September 26, 2013. Tom Holley, Larry Thompson and John Wooster (NMFS) were present for the YCWA Relicensing Study 7.11a Telemetry Technical Review.

In addition to the Relicensing Participants meetings, YCWA held informal meetings with NMFS and FERC.

- June 1, 2011. Participants included Alan Mitchnick and Ken Hogan (FERC), Gary Sprague (NMFS), Curt Aikens, Geoff Rabone, Alan Lilly, Tom Johnson and Jim Lynch (YCWA). The meeting participants discussed defining terms that are used in both ESA-related documents and National Environmental Policy Act (NEPA)-related documents, potential information gaps, new and altered studies requested by NMFS, and schedule and topics for future meetings.
- June 6, 2011. Meeting participants included Alan Mitchnick, Ken Hogan (FERC), Gary Sprague (NMFS), Geoff Rabone, Alan Lilly and Jim Lynch (YCWA). Meeting participants discussed revisions to the June 1, 2011 meeting summary, action items from that June 1, 2011 meeting, ESA and FERC's NEPA process, potential information gaps, the schedule for meetings in July and August 2011.
- June 17, 2011. Meeting participants included Alan Mitchnick, Ken Hogan (FERC), Gary Sprague, Richard Wantuck, Larry Thompson, John Wooster, Tom Holley (NMFS), Curt Aikens, Geoff Rabone, Alan Lilly, Tom Johnson, Paul Bratovich and Jim Lynch

(YCWA). The meeting participants discussed potential information gaps for ESA consultation, and fish passage.

- July 12, 2011. Meeting participants included Alan Mitchnick, Ken Hogan (FERC), Gary Sprague, Richard Wantuck (NMFS), Curt Aikens, Geoff Rabone, Alan Lilly, and Jim Lynch (YCWA). The meeting participants discussed potential information gaps for ESA consultation, new and altered studies requested by NMFS, and schedule and topics for future meetings.
- April 20, 2012. Meeting participants included Alan Mitchnick, Ken Hogan (FERC), Gary Sprague, Richard Wantuck (NMFS), Geoff Rabone, Alan Lilly, Paul Bratovich, Bill Snider and Jim Lynch (YCWA). The meeting participants discussed the organization and schedule for preparation of the Applicant-Prepared Draft Biological Assessment and Applicant-Prepared Draft Essential Fish Habitat Assessment, and topics for future meetings.

YCWA has attempted to schedule additional consultation meetings with NMFS, but NMFS staff has been unavailable due to their heavy workload.

3.2 Key Consultation Considerations

3.2.1 NMFS 2005 Biological Opinion (Yuba River Development Project License Amendment)

In October 2003, FERC requested initiation of early consultation on the proposed amendment to the license for the Project (FERC Project No. 2246) in order to authorize YCWA to construct and operate a full-flow bypass at its Narrows 2 Powerhouse at Englebright Dam, and to revise the flow reduction and fluctuation criteria in YCWA's FERC license. The new bypass and the revised flow reduction and fluctuation criteria were designed to minimize the possibility that emergencies and other events requiring that the Narrows 2 Powerhouse be taken offline would cause significant flow fluctuations in the lower Yuba River, and thereby minimize the possibility that such fluctuations would strand juvenile spring-run Chinook salmon and steelhead, or dewater redds of those species (NMFS 2005).

Before this bypass was completed, flow reductions resulting from emergency and accidental shutdowns of the Narrows 2 Powerhouse were a major concern due to adverse flow and water temperature effects on listed spring-run Chinook salmon and steelhead. The ability to manage releases from Englebright Dam during maintenance and emergency operations was limited by the design of Englebright Dam and the bypass capability of the Narrows 2 Powerhouse, which was previously only able to bypass 650 cfs (or approximately 20 %) of the 3,400 cfs capacity of the powerhouse. In the past, uncontrolled flow reductions due to unexpected outages at Narrows 2 adversely affected spawning redds and fry and juvenile rearing areas (FERC 2001). However, with the completion of the full-flow bypass in 2006, adverse effects to listed species due to flow and water temperature effects related to emergencies, maintenance, and accidental shut-downs of the powerhouse have been virtually eliminated.

On January 26, 2005, NMFS issued a preliminary BO to FERC analyzing the potential effects of the License amendment on Central Valley spring-run Chinook salmon and Central Valley steelhead. Subsequent to the completion of the preliminary BO, the Action Area for the project was proposed for designation as critical habitat for these two species (NMFS 2005). In addition, the southern DPS of North American green sturgeon was proposed for listing as threatened throughout its range within the Sacramento/San Joaquin river systems, which included the lower Yuba River (NMFS 2005).

NMFS' (2005) final BO, issued on November 4, 2005, concluded that the effects of the proposed Project license amendment for FERC License No. 2246 was not likely to jeopardize the continued existence of Central Valley spring-run Chinook salmon or Central Valley steelhead, or destroy or adversely modify designated critical habitat for these species. NMFS (2005) also concluded that the effects of the project are not likely to jeopardize the continued existence of the southern DPS of North American green sturgeon.

3.2.2 NMFS 2012 Biological Opinion (Corps Operation and Maintenance of Englebright Dam and Daguerre Point Dam)

The Corps Sacramento District reinitiated formal consultation with NMFS on the Corps' ongoing operation and maintenance of Englebright Dam and Daguerre Point Dam and associated facilities in January 2012. A BA (referred to herein as the Corps 2012 BA) was prepared to, among other things, describe the Proposed Action and analyze the effects of that action on listed species and designated critical habitat.

As discussed in the Corps 2012 BA, the Corps' responsibilities, as well as its ability to conduct operations- and maintenance-related actions at Englebright Dam and Reservoir and at Daguerre Point Dam, are primarily governed by each of the facilities' respective authorized purposes. Consequently, the Corps' actions that were proposed and evaluated in the Corps 2012 BA, which could potentially affect listed fish species in the lower Yuba River, were somewhat limited.

Several recent actions affected listed species and their critical habitats in the lower Yuba River prior to the 2012 reinitiation of consultation between the Corps and NMFS, including:

- *March 2008*. The State Water Resources Control Board (SWRCB) approved the changes in the water right permits of YCWA that were necessary to implement the Yuba Accord.
- *June 2009*. YCWA entered into a Settlement Agreement with Plaintiffs South Yuba River Citizens League (SYRCL) and Friends of the River (FOR) in their lawsuit against NMFS et al. This settlement resulted in improvements to the maintenance and operations of the South Yuba/Brophy diversion channel and facilities.
- *June 2009*. NMFS issued its Biological Opinion and Conference Opinion on the Long-term Operations of the Central Valley Project (CVP) and State Water Project (SWP).
- *October 2009*. NMFS issued the Draft Recovery Plan for the Evolutionarily Significant Units (ESUs) of Sacramento River Winter-run Chinook Salmon and Central Valley

Spring-run Chinook Salmon, and the Distinct Population Segment (DPS) of Central Valley Steelhead.

- *October 2009*. NMFS issued its final rulemaking to designate critical habitat for the threatened Southern DPS of North American green sturgeon.

On February 29, 2012, NMFS issued its Final BO (2012 BO) regarding the effects of Englebright Dam and Daguerre Point Dam on Central Valley spring-run Chinook salmon, Central Valley steelhead, the Southern Distinct Population Segment of North American green sturgeon, and their designated Critical Habitats.

The 2012 BO concluded that the operation and maintenance of these two dams, as proposed by the Corps, would likely jeopardize the continued existence of spring-run Chinook salmon, steelhead, and green sturgeon, and result in the adverse modification of critical habitat for each of these species. The 2012 BO included a reasonable and prudent alternative (RPA) that the 2012 BO states would have modified the Corps' Proposed Action to avoid jeopardizing the species and adversely modifying their critical habitats. The RPA was divided into eight categories containing almost 60 specific actions to be implemented by the Corps.

The Corps sent a letter to NMFS on July 3, 2012 acknowledging receipt of the 2012 BO. Although the Corps conditionally accepted the RPA described in the 2012 BO, the Corps expressed serious concerns about various aspects of the BO that needed to be resolved.

To resolve these issues, the Corps requested reinitiation of consultation on February 26, 2013. According to the August 12, 2013 Memorandum and Order of the United States District Court, Eastern District of California, in Case No. 2:13-cv-00042-MCE-CKD, during the pendency of the reinitiation process, NMFS may not cite nor rely on the 2012 BO or its RPA, in any further filings with FERC involving specified relicensing proceedings, including YCWA's Project (FERC Project No. 2246).

3.2.2.1 Litigation Regarding the NMFS 2012 BO (Corps Operation and Maintenance of Englebright Dam and Daguerre Point Dam)

The following paragraphs describe the primary pre-litigation and litigation actions that have been taken regarding the NMFS 2012 BO.

- *November 6, 2012*. YCWA files a 60-day Notice of Intent to Sue for Violations of Endangered Species Act, Administrative Procedure Act, and National Environmental Policy Act Relating to the February 29, 2012 BO and July 3, 2012 Corps of Engineers Conditional Acceptance of the RPA.
- *November 13, 2012*. Environmental Advocates, on behalf of SYRCL, files a 60-day Notice of Violation and Intent to File Suit under the ESA regarding Corps' implementation of 2012 BO's RPA.

- *January 9, 2013*. YCWA files a lawsuit complaint against NMFS and the Corps for declaratory and injunctive relief with the United States District Court, Eastern District of California challenging NMFS's issuance of the February 29, 2012 Final BO and Corps' conditional acceptance of RPA. YCWA v. NMFS, Civil Case No. 2:13-cv-00042.
- *January 11, 2013*. Environmental Advocates, on behalf of SYRCL, files a lawsuit complaint against NMFS for declaratory and injunctive relief with the United States District Court, Eastern District of California, challenging NMFS's November 27, 2012 extensions of RPA implementation deadlines specified in the February 29, 2012 Final BO, SYRCL v. NMFS, Civil Case No. 2:13-cv-00059.
- *January 28, 2013*. SYRCL files first amended complaint against NMFS and Corps.
- *April 10, 2013*. SYRCL files second amended complaint against NMFS and Corps.
- May 10, 2013. Federal defendants filed motion for voluntary remand or stay of proceedings in YCWA v. NMFS case.
- May 30, 2013. Federal defendants filed motion for stay of proceedings in SYRCL v. NMFS case.
- August 12, 2013. Court issued its Memorandum and Order in SYRCL v. NMFS and YCWA v. NMFS, cases. This order: 1) granted the federal defendants' motions for stay in both cases; 2) directed the Corps to submit its final BA for the reinitiated Corps/NMFS ESA consultation described above by October 22, 2013; 3) directed NMFS to file its final BO for this consultation by May 12, 2014; and 4) provided that the stays will automatically be lifted, without further court order, upon issuance of this BO. This order further provided that, during the pendency of the reinitiated consultation, "NMFS will not cite nor rely on the 2012 BO or its RPAs, in any further filings with FERC involving" specified relicensing proceedings, including YCWA's Project (FERC Project No. 2246). This order also directed NMFS, during this same period, "not to directly or indirectly rely on the 2012 BiOp or any of its provisions for purposes of establishing the environmental [baseline] in any consultations regarding the aforementioned relicensing proceedings."

3.2.3 Other Activities

3.2.3.1 Lower Yuba River Accord

In 2005, YCWA and 16 other interested parties signed memoranda of understanding that specified the terms of the Lower Yuba River Accord (Yuba Accord), a comprehensive, consensus-based program to protect and enhance aquatic habitat in the Yuba River downstream of Englebright Dam. Following environmental review, YCWA and parties executed the following four agreements in 2007, which together comprise the Yuba Accord: 1) the Lower Yuba River Fisheries Agreement, which specifies the Yuba Accord's lower Yuba River minimum streamflows and creates a detailed fisheries monitoring and evaluation program; 2) the Water Purchase Agreement, under which DWR purchases water, some of which is provided by the Yuba Accord's minimum streamflows, from YCWA's for CALFED's[3] Environmental Water Account and State Water Project and Central Valley Project contractors; 3) the Conjunctive Use Agreements with seven of YCWA's member units, which specify the terms of the Yuba Accord's groundwater conjunctive-use program; and 4) amendments to the 1966 Power Purchase Contract between YCWA and PG&E.

The Yuba Accord was developed by a multi-agency resource team, including representatives from NMFS, USFWS, Cal Fish and Wildlife, and a group of NGOs. The Yuba Accord flow schedules were developed to essentially optimize habitat conditions for anadromous fish during high flow years for this regulated river system. Subsequently, additional flow schedules were developed by the resources team for drier conditions that included a "balancing of resources" approach.

YCWA has been operating the Project in conformance with the Yuba Accord since 2006. The 2006, 2007, and early 2008 operations were under 1-year pilot programs that were approved by the SWRCB.

The Yuba Accord includes a specific set of flow schedules for the Yuba River. The flow schedule that is in effect at any particular time is determined by the North Yuba Index (NYI), a hydrologic index that was developed as a part of the Yuba Accord. The flow schedules are listed in Table 3.2.3-1. The NYI is depicted in Figure 3.2.3-1.

During Conference Years, or years when the NYI is less than 500,000 ac-ft, which are expected to occur approximately 1 percent of the time, YCWA is required: 1) to maintain minimum instream flows in the Yuba River at the levels specified in Article 33 of YCWA's existing FERC license without the reductions authorized by subsections (c) and (d) of that article; 2) to release any supplemental flows recommended by the Lower Yuba Accord River Management Team (RMT) and approved by the SWRCB's Deputy Director for Water Rights or, if no such recommended flows are effective by April 11 of such a Conference Year, then to release any supplemental flows ordered by the SWRCB, after a hearing under California Code of Regulations, title 23, section 767; and 3) to limit total water supply diversions at Daguerre Point Dam to 250,000 ac-ft.

The original Yuba Accord Conference Year flow schedules were equivalent to the minimum flow schedules included in Licensee's original 1963 FERC license. Biological understanding of the Yuba River since 1963, including work overseen by the RMT since 2007, have suggested improvements in the Conference Year flow schedules, which are included in Licensee's proposal.

First, the total Conference Year flow schedule volume included in Licensees proposal is approximately 15percent greater than the Conference Year flow schedules included in the Yuba Accord Conference Year flow schedules. The total annual Conference Year flow schedule volume is 199,228 acre-feet in Licensees proposal, and 173,111 acre-feet in the Yuba Accord.

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[3] Interagency committee with management and regulatory responsibility for Bay-Delta Estuary.

Second, the potential for redd dewatering has been studied by Licensee and the RMT during the past seven years. As a result, Licensee is proposing a more consistent Conference Year flow schedule during the November through March time frame (consistent with spawning and the incubation period of Chinook salmon in the Yuba River). Licensee believes that this consistent flow level will provide less potential for redd dewatering than the original Conference Year flow schedules in the 1963 FERC license. This also represents an approximate 8.5percent increase in total volume of Conference Year releases during the November through March time period.

Third, Licensee believes that slightly higher Conference Year releases during the summer months (July through September) could provide better thermal conditions in the Yuba River than the Conference Year releases included in the 1963 FERC license. Accordingly, Licensee suggests additional releases totaling 14,572 acre-feet, or approximately 114percent increase during the July through September time period.

Table 3.2.3-1. Yuba Accord flow schedules.

Schedule	Oct	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Apr	May	May	Jun	Jun	Jul	Aug	Sep	Total Annual Vol. (ac-ft)
	1-15	16-30	1-30	1-31	1-31	1-29	1-31	1-15	16-30	1-15	16-31	1-15	16-30	1-31	1-31	1-30	
MARYSVILLE GAGE (cfs)																	
1	500	500	500	500	500	500	700	1,000	1,000	2,000	2,000	1,500	1,500	700	600	500	574,200
2	500	500	500	500	500	500	700	700	800	1,000	1,00	800	500	500	500	500	429,066
3	500	500	500	500	500	500	500	700	700	900	900	500	500	500	500	500	398,722
4	400	400	500	500	500	500	500	600	900	900	600	400	400	400	400	400	361, 944
5	400	400	500	500	500	500	500	500	600	600	400	400	400	400	400	400	334,818
6	350	350	350	350	350	350	350	350	500	500	400	300	150	150	150	350	232,155
SMARTsVILLE GAGE (cfs)																	
A	700	700	700	700	700	700	700	700	--	--	--	--	--	--	--	700	--
B	600	600	600	550	550	550	550	600	--	--	--	--	--	--	--	500	--

Notes:
Marysville Gage flows represent average volumes for the specified period. Actual flows may vary from the indicated flows according to established criteria.
Marysville Gage Schedule 6 flows do not include an additional 30,000 ac-ft that must be made available from groundwater substitution and that will be allocated to instream flows according to established criteria during Schedule 6 years.
Smartsville Gage Schedule A is used with Marysville Schedules 1, 2, 3, and 4.
Smartsville Gage Schedule B is used with Marysville Schedules 5 and 6.

FLOW SCHEDULE YEAR TYPES

BASED ON THE NORTH YUBA INDEX

FOR ESTABLISHING REQUIRED FLOWS IN THE LOWER YUBA RIVER FISHERIES AGREEMENT

The water year hydrologic classification for the Yuba River to determine the flow requirements of Yuba County Water Agency's water right permits shall be based on the North Yuba Index. Determinations of a year's flow schedule year type shall be made in February, March, April, and May and for any subsequent updates.

Flow Schedule Year Type	North Yuba Index Thousand Acre-Feet (TAF)
Schedule 1	Equal to or greater than 1400
Schedule 2	Equal to or greater than 1040 and less than 1400
Schedule 3	Equal to or greater than 920 and less than 1040
Schedule 4	Equal to or greater than 820 and less than 920
Schedule 5	Equal to or greater than 693 and less than 820
Schedule 6	Equal to or greater than 500 and less than 693
Conference Year	Less than 500

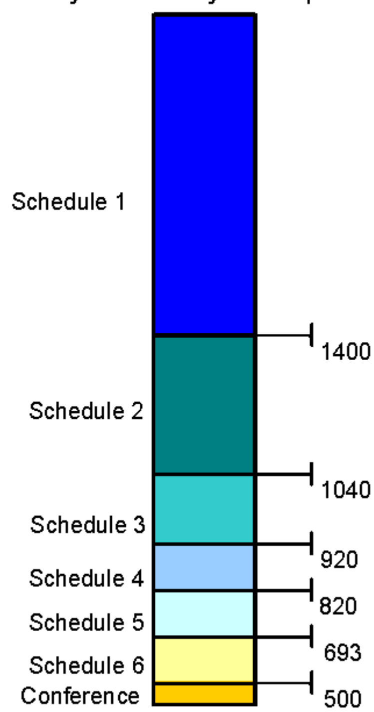

Figure 3.2.3-1. Yuba Accord North Yuba Water Year Type Index.

3.2.3.2 NMFS Recovery Planning

Section 4(f) of the Federal Endangered Species Act of 1973 (16 U.S.C. § 1533(f)) directs NMFS to develop and implement plans for the conservation and survival of NMFS-listed species. On October 7, 2009, NMFS published in the Federal Register (74 FR 51553) a notice of availability of a Public Review Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook Salmon, Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead (NMFS 2009b - Draft Salmonid Recovery Plan). A Final Recovery Plan is expected to be released during 2013.

The NMFS Draft Salmonid Recovery Plan states in part: "*Recovery plans are not regulatory documents and successful implementation and recovery of listed species will require the support, efforts and resources of many entities, from Federal and state agencies to individual members of the public. Another goal will be to encourage and support effective partnerships with regional stakeholders to meet the objectives and criteria of the Recovery Plan*."

The recommended recovery actions under the NMFS Draft Salmonid Recovery Plan for the Yuba River include: (1) conducting feasibility studies, habitat evaluations, pilot testing programs and implementing long-term fish passage programs for a phased approach to salmon reintroduction planning to recolonize historic habitat above Englebright Dam; and (2) improving spawning habitat in the lower Yuba River below Englebright Dam.

3.2.3.3 Yuba Accord Monitoring and Evaluation Program

On March 18, 2008, the SWRCB approved a consensus-based, comprehensive program to protect and enhance approximately 24 miles of aquatic habitat in the lower Yuba River4, extending from Englebright Dam downstream to the river's confluence with the Feather River near Marysville. This program is known as the Lower Yuba River Accord (Yuba Accord).

The Yuba Accord consists of a Fisheries Agreement and several other elements including any necessary Conjunctive Use Agreements, and a Water Purchase Agreement. Sections of the Fisheries Agreement most pertinent to the Yuba Accord River Management Team (RMT), the River Management Fund (RMF), and the Monitoring and Evaluation Program (M&E Program) are described below. The Fisheries Agreement in its entirety can be found as Exhibit YCWA-9 on the SWRCB website[5].

The RMT Planning Group (herein referred to as the RMT) includes representatives of the YCWA, NMFS, USFWS, Cal Fish and Wildlife, PG&E, DWR and the non-governmental organizations (NGOs - American Rivers, The Bay Institute, the South Yuba River Citizens League, and Trout Unlimited) that are parties to the Fisheries Agreement.

The Fisheries Agreement enables the RMT to address operational, monitoring, and enhancement actions through fisheries monitoring, studies, and enhancement programs, with the use of RMF expenditures. The Fisheries Agreement describes that the purposes of the RMF are:

> To ensure reasonable and prudent disbursement of funds, the RMT will adopt a structure for fund allocation based on specific prioritized goals for monitoring studies, actions, and activities. Money from the RMF may be spent for any of the following actions:
>
> - Monitoring and evaluating the effectiveness of the implementation of the Lower Yuba River Accord, including flow schedules, Conference Year flows, and the Water Purchase Agreement;

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[4] River mile distances reported in this document extend upstream from the mouth of the lower Yuba River, and are based upon previously reported linear distances estimated through evaluation of topographic maps. Alternative representations of linear distances of the lower Yuba River are based upon the valley centerline, and the baseflow thalweg centerline (Wyrick and Pasternack 2012).

[5] http://www.waterboards.ca.gov/waterrights/water_issues/programs/hearings/lower_yuba_accord/exhibits.shtml

- Evaluating the condition of fish resources in the Lower Yuba River; and
- Evaluating the viability of Lower Yuba River fall-run Chinook salmon and any subpopulations of the Central Valley steelhead and spring-run Chinook salmon Evolutionarily Significant Units (ESUs) that may exist in the Lower Yuba River.

The RMT developed the M&E Program to guide the efficient expenditure of RMF funds to evaluate the biological provisions of the Fisheries Agreement of the Yuba Accord. In addition, the parties to the Fisheries Agreement intended that the monitoring and data collection activities implemented via the M&E Program will produce a useful database for the proceedings of the FERC regarding the relicensing of YCWA's Project (FERC Project No. 2246).

The primary purpose of the M&E Program is to provide the monitoring data necessary to evaluate whether implementation of the Yuba Accord flow schedules are "protective" of the fish and aquatic habitat resources of the lower Yuba River. Recently, the RMT (2013) released a draft M&E Program Interim Report (Interim Report) to compile and display the results of multiple years of RMT-led monitoring efforts, and discuss the results of these efforts within a comprehensive context. Although a substantial amount of data has been collected, monitoring is ongoing. Thus, the Interim Report was intended to facilitate adaptive management and refinement of the monitoring program, as appropriate. The Interim Report describes results of monitoring conducted to date and evaluates the efficacy of the Yuba Accord flow schedules.

3.2.3.4 Yuba Salmon Forum

The Yuba Salmon Forum (YSF) is comprised of a stakeholder group including YCWA, NMFS, the Corps, Cal Fish and Wildlife, USFWS, SWRCB, Placer County Water Agency (PCWA), PG&E, the U.S. Forest Service (Forest Service), and non-governmental organizations (NGOs), including American Rivers, American Whitewater, California Sportfishing Protection Alliance, Foothills Water Network, Sierra Club, South Yuba River Citizens League, and Trout Unlimited. According to the YSF Final Charter (April 2011) the purpose of the YSF is *"… to identify, evaluate, recommend, and seek to achieve implementation of effective near-term and long-term actions to achieve viable salmonid populations in the Yuba River watershed to contribute to recovery goals, while also considering other beneficial uses of water resources and habitat values in neighboring watersheds, as part of Central Valley salmonid recovery actions*". The YSF process is ongoing.

3.2.3.5 North Yuba Reintroduction Initiative

YCWA, NMFS, USFWS, Forest Service, Cal Fish and Wildlife, American Rivers and Trout Unlimited initiated the NYRI to collaborate in efforts to develop an NYRI Plan, which was intended to: (1) provide for the consideration, and preparation where necessary, of studies of potential actions to enhance habitat conditions for salmonids in the Yuba River above passage barriers; and (2) provide for potential actions to recolonize historic Central Valley spring-run Chinook salmon and Central Valley steelhead habitat on the North Yuba River above New

Bullards Bar Dam and Reservoir in a manner consistent with the NMFS Draft Salmonid Recovery Plan. Although these parties executed the NYRI Process Agreement, which provides a framework for potential development of the NYRI Plan, the process has not been pursued for the past year.

3.2.3.6 Habitat Enhancement Program

DWR and PG&E prepared the Final Habitat Expansion Plan (HEP) as part of the Oroville FERC relicensing process. The plan was submitted to NMFS for approval on November 19, 2010. The recommended actions in the Final HEP (DWR and PG&E 2010) consisted of the following three components, collectively referred to as the Lower Yuba River Actions:

- Expansion of spawning habitat at Sinoro Bar in the Englebright Dam Reach above the Deer Creek confluence;
- Expansion of spawning habitat at Narrows Gateway in the Narrows Reach below the Deer Creek confluence; and
- The option of planning for and installing a seasonally operated segregation weir on the Yuba River below the outlet of the Narrows Pool to segregate spring-run and fall-run Chinook salmon, if deemed necessary by the resource agencies (NMFS, USFWS, and Cal Fish and Wildlife).

The Lower Yuba River Actions would achieve the goals of the Habitat Expansion Agreement by expanding habitat in the Yuba River below Englebright Dam to support spawning, rearing, and adult holding of spring-run Chinook salmon and steelhead (DWR and PG&E 2010).

3.2.3.7 Other Yuba River Basin FERC Relicensing Efforts

There are three ongoing FERC relicensing proceedings for hydroelectric power projects within the Yuba watershed. The first is South Feather Water and Power Agency's (SFWPA) 117.5-mgawatt (MW) South Feather Power Project, FERC Project No. 2088. The water supply/power project was constructed in the late 1950s/early 1960s. None of the project facilities or features is located in the Yuba River watershed except for the Slate Creek Diversion Dam, which is located on a tributary to the North Yuba River. Slate Creek Diversion Dam and the associated tunnel have the capacity to divert up to 848 cfs of water out of Slate Creek, and to convey it to Sly Creek Reservoir on Lost Creek, a tributary to the South Fork Feather River. SFWPA's water rights limit Slate Creek diversions to 600 cfs and at times diversions are limited to 500 cfs due to high water elevations in Sly Creek Reservoir. In anticipation of the expiration of the initial license, on March 31, 2009, South Feather Water and Power filed with FERC an application for a new license on March 6, 2007. Since the initial license expired, SFWPA has operated the project under annual licenses from FERC and will continue to do so until a new license is issued.

The second ongoing relicensing is Nevada Irrigation District's (NID) 79.3-MW Yuba-Bear Hydroelectric Project, FERC Project No. 2266. This is a water supply/power project constructed in the mid-1960's, though some project facilities were initially constructed in the late 1800's. The project includes a storage reservoir on the Middle Yuba River (i.e., Jackson Meadows Reservoir) with a gross storage capacity of 69,205 ac-ft, and five storage reservoirs on Canyon

Creek (i.e., Jackson, French, Faucherie, Sawmill and Bowman) with a combined gross storage capacity of 90,790 ac-ft). The project also includes a diversion with a maximum capacity of about 450 cfs via the Milton-Bowman Diversion Dam from the Middle Yuba River to Bowman Lake on Canyon Creek, and a diversion with a maximum capacity of about 300 cfs via the Bowman-Spaulding Canal from Bowman Lake on Canyon Creek to PG&E'S Spaulding Reservoir on the South Yuba River. In anticipation of the expiration of the initial license on April 30, 2013, NID filed with FERC an application for a new license on April 15, 2011. Since the initial license expired, NID has operated the project under annual licenses from FERC and will continue to do so until a new license is issued.

The third ongoing relicensing in the watershed is PG&E's 190-MW Drum-Spaulding Project, FERC Project No. 2310, which is located on the South Yuba River, Bear River, North Fork of the North Fork American River and tributaries to the Sacramento River Basin in Nevada and Placer counties, California. Major reservoirs of the project include Lake Spaulding (74,773 ac-ft) on the South Yuba River and Fordyce Lake (49,903 ac-ft) on Fordyce Creek upstream of Lake Spaulding. In addition, the project includes numerous smaller reservoirs on tributaries to the South Yuba River, and diversions from the South Yuba River to Deer Creek via the South Yuba Canal (maximum capacity of ~126 cfs) and to the Bear River via the Drum Canal (~840 cfs). In anticipation of the expiration of the initial license on April 30, 2013, PG&E filed with FERC an application for a new license on April 12, 2011. Since the initial license expired, PG&E has operated the project under annual licenses from FERC and will continue to do so until a new license is issued.

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SECTION 4.0

DESCRIPTION OF THE PROPOSED ACTION

This section describes the existing Project and YCWA's proposed changes to the existing Project (i.e., YCWA's proposed Project).

4.1 Existing Project Facilities

The existing Project includes three developments – New Colgate, New Bullards Bar Minimum Flow and Narrows 2 - each of which is described below.

The existing Project can store approximately 966,770 ac-ft of water (gross storage), and has generated an average of about 1,278,585 megawatt hours per year (MWh/yr) of power annually from 2008 through 2012. The existing Project's total installed capacity is 361,900 kilowatts (kW) and the dependable capacity is 248,080 kW. Table 4.1-1 and Table 4.1-2 summarize key information for Project powerhouses and reservoirs, respectively.

Table 4.1-1. Key information regarding Yuba River Development Project powerhouses.

Powerhouse	Unit	Turbine Type	Rated Head (ft)	Rated Hydraulic Capacity (cfs)		Generation Capacity (kW)		Average Annual Energy (MWh/yr)3
				Minimum	Maximum	Nameplate Rating1	Dependable2	
New Colgate	1	Pelton	1,306	0	1,715	157,500	231,497	1,233,701
New Colgate	2	Pelton	1,306	0	1,715	157,500		
New Bullards Bar Minimum Flow	1	Pelton	561	0	5	150	57	952
Narrows 2	1	Francis	236	600	3,400	46,750	0	172,780
Total	4	--	--	--	--	361,900	231,554	1,407,433

1 From Table 5.2-5 in Exhibit D.
2 From Table 5.2-7 in Exhibit D (i.e., modeled dependable capacity from Water Year (WY) 1970 through WY 2010).
3 From Table 5.2-2 in Exhibit D (i.e., modeled average annual generation from WY 2070 through WY 2010).

Table 4.1-2. Key information regarding Yuba River Development Project reservoirs and impoundments.

Project Reservoir	NMWSE1 (ft)	Gross Storage2 (ac-ft)	Usable Storage2 (ac-ft)	Surface Area2 (ac)	Maximum Depth2 (ft)	Shoreline Length2 (mi)	Drainage Area3 (sq mi)
Our House Diversion Dam Impoundment	2,030	280	None	14	65	0.7	144.8
Log Cabin Diversion Dam Impoundment	1,970	90	None	5	40	0.4	29.1
New Bullards Bar Reservoir	1,956	966,400	966,103	4,790	636	71.9	466.6
Total	--	966,770	966,103	4,809	--	--	--

1 NMWSE = Normal Maximum Water Surface Elevation
2 At NMWSE
3 At the dam, and drainage areas are not additive.

4.1.1 New Colgate Development

The New Colgate Development consists of the following features:

1. Our House Diversion Dam is a 130-foot (ft) radius, double curvature, concrete arch dam located in Sierra County on the Middle Yuba River 12.6 miles (mi) upstream of its confluence with the North Yuba River. The dam is 70 ft high with a crest length of 368 ft and a crest elevation of 2,030 ft, and has a drainage area of 144.8 square s (sq mi). The dam has a spillway, a fish release outlet valve used for releasing minimum flow requirements in the existing FERC license, and a low level (5-foot diameter) outlet valve.[6] The spillway, with an invert elevation of 2,030 ft is ungated and has a maximum capacity of 60,000 cubic ft per second (cfs). The fish release outlet valve has an invert elevation of 1,990 ft, and an engineer's estimated maximum capacity of 59 cfs[7] when the pool is at the invert (2,015 ft) of the Lohman Ridge Diversion Tunnel. The fish release outlet is controlled by a hand-operated 24-inch (in) valve on the downstream end of the outlet. The low level outlet has an invert elevation of 1,987 ft, and an engineer's estimated maximum capacity of 463 cfs[8] when the pool is at the invert of the Lohman Ridge Diversion Tunnel. The low level outlet is controlled by a slide gate, which is operated by a two-person mobile gasoline powered engine, on the upstream face of the dam.

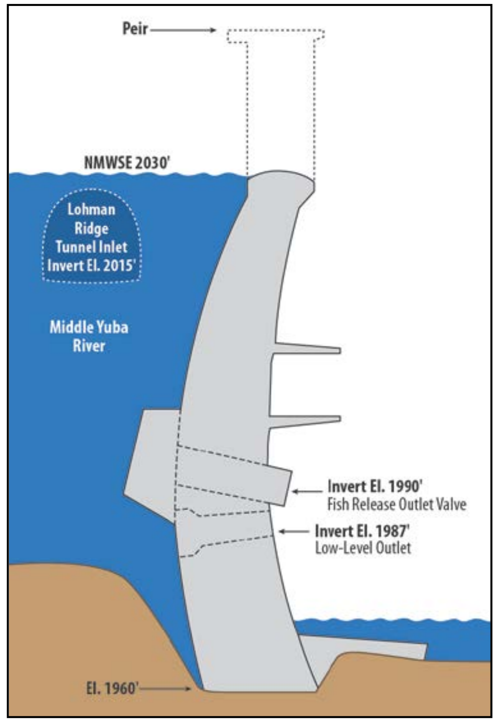

Figure 3.1-1. Our House Diversion Dam

2. Our House Diversion Dam Impoundment, a 280 ac-ft impoundment formed by Our House Diversion Dam.

3. Lohman Ridge Diversion Tunnel, a 12.5-ft high by 12.5-ft wide tunnel that conveys a maximum flow of 860 cfs through its 19,410 ft (90% unlined and 10% lined) length from the Middle Yuba River to Oregon Creek. The invert of the tunnel intake is at elevation 2,015, ft, which is 15 ft below the normal maximum water surface elevation (NMWSE) for Our House Dam (i.e., water can only be diverted through the tunnel when the impoundment's WSE is 2,015 or greater).

[6] For the purpose of the application, the slide gate that controls the Our House Diversion Dam low level outlet is referred to as a "valve."
[7] YCWA plans to rate the Our House Diversion Dam fish release valve in spring 2015.
[8] YCWA plans to rate the Our House Diversion Dam low level outlet valve in spring 2015.

4. Log Cabin Diversion Dam, is a 105-ft radius, concrete arch dam located in Yuba County on Oregon Creek 4.3 mi upstream of the confluence with the Middle Yuba River. The dam is 42.5 ft high with a crest length of 300 ft, a crest elevation of 1,970 ft, and a drainage area of 29.1 sq mi. The dam has a spillway, a fish release outlet valve used for releasing minimum flow requirements in the existing FERC license, and a low level (5-ft diameter) outlet valve.[9] The spillway, with an invert elevation of 1,970 ft is ungated and has a maximum capacity of 12,000 cfs. The fish release outlet valve has an invert elevation of 1,947 ft and an engineer's estimated maximum capacity of 18 cfs[10] when the pool is at the invert (1,952 ft) of the Camptonville Diversion Tunnel. The outlet is controlled by a hand-operated valve on the downstream end of the outlet. The low level outlet has an invert elevation of 1,935 ft, and an engineer's estimated maximum capacity of 348 cfs[11] when the pool is at the invert of the Camptonville Diversion Tunnel. The low level outlet is controlled by a slide gate, which is operated by a two-person mobile gasoline powered engine, on the upstream face of the dam.

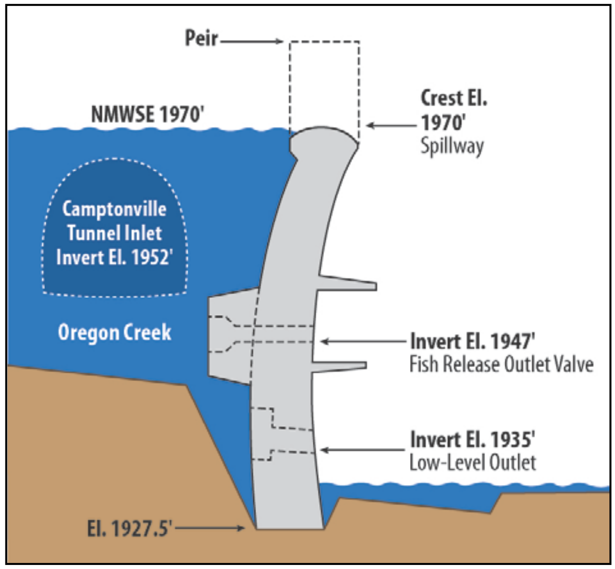

Figure 3.1-2. Log Cabin Diversion Dam features.

5. Log Cabin Diversion Dam Impoundment, a 90 ac-ft impoundment formed by Log Cabin Diversion Dam.

6. Camptonville Diversion Tunnel, a 6,107-ft long tunnel that has the capacity to convey 1,100 cfs of water from Oregon Creek to New Bullards Bar Reservoir on the North Yuba River. The first 4,275 ft of the conduit is an unlined, horseshoe-shaped tunnel 14.5 ft wide by 14.5 ft high, which (for the last 1,832 ft) becomes a lined, horseshoe-shaped tunnel 11.7 ft wide by 13 ft high. The tunnel invert elevation is 1,952 ft, which is 18 ft below the NMWSE for Log Cabin Diversion Dam (i.e., water can only be diverted through the tunnel when the impoundment's WSE is greater than 1,952 ft).

7. New Bullards Bar Dam, a 1,110-ft radius, double curvature, concrete arch dam located on the North Yuba River about 2.4 mi upstream of its confluence with the Middle Yuba River. The dam is 645 ft high with a maximum elevation of 1,965 ft. The dam includes one low-level outlet – a 72-in Hollow Jet Valve (invert elevation 1,444.5 ft) with a

[9] For the purpose of the application, the slide gate that controls the Log Cabin Diversion Dam low level (5-foot diameter) outlet is referred to as a "valve."
[10] YCWA plans to rate the Log Cabin Diversion Dam fish release valve in spring 2015.
[11] YCWA plans to rate the Log Cabin Diversion Dam low level outlet valve in spring 2015.

maximum design capacity of about 3,500 cfs at full reservoir pool, and an actual capacity of 1,250 cfs (i.e., actual release capacity is limited to 1,250 cfs because of valve vibrations at higher release rates). The dam includes an overflow-type spillway with a width of 106 ft and a crest elevation of 1,902 ft. Control gates on the spillway consist of three Tainter Gates measuring 30 ft wide and 54 ft tall, and hoisted by 10 horsepower drum hoists. The maximum design capacity of the spillway is 160,000 cfs. Figure 4.1-3 provides a longitudinal schematic of New Bullards Bar Dam.

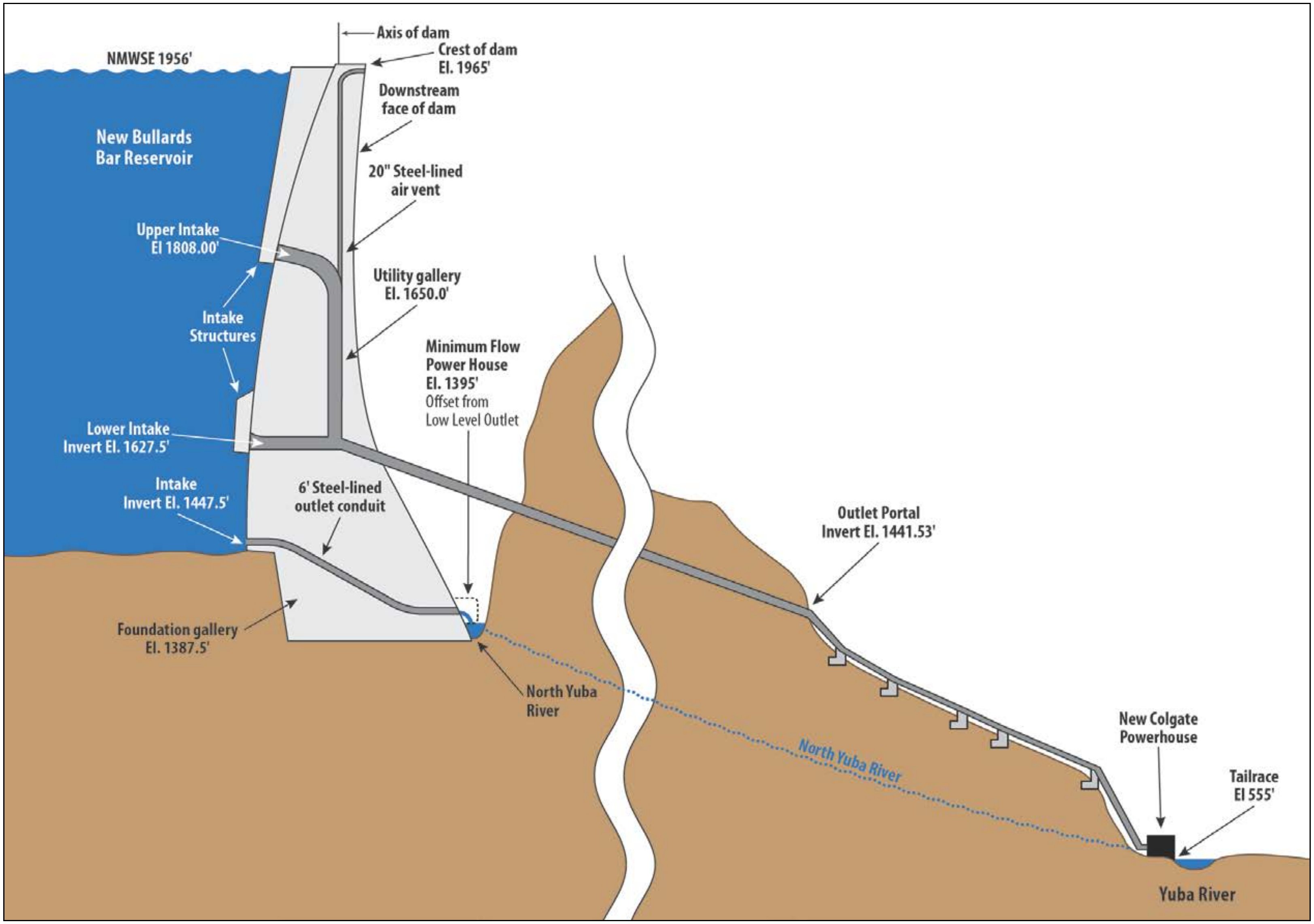

Figure 4.1-3. Longitudinal schematic of New Bullards Bar Dam on the North Yuba River and New Colgate Power Tunnel and Powerhouse on the Yuba River.

8. New Bullards Bar Reservoir, a storage reservoir on the North Yuba River formed by New Bullards Bar Dam. At NMWSE (1,956 ft), New Bullards Bar Reservoir extends about 15.3 river s upstream on the North Yuba River, has an estimated storage capacity of 966,103 ac-ft, a surface area of 4,790 ac, a shoreline of about 71.9 mi, and a drainage area of 488.6 sq mi.

9. New Colgate Power Tunnel Intake, a structure on the upstream face of New Bullards Bar Dam composed of a curtain wall, trashrack and two intakes, one with an invert elevation of 1,808 ft and the other with an invert elevation of 1,627.5 ft. The upper intake is not used per the direction of Cal Fish and Wildlife. (Figure 4.1-3).

10. New Colgate Power Tunnel and Penstock, a 5.2 mi long conveyance facility composed of four different types of conveyance structures: an unlined horseshoe-shaped tunnel 26 ft square; a lined horseshoe-shaped tunnel 20 ft wide and 14.5 ft high; a lined circular tunnel 14 ft in diameter; and 2,809 ft of steel penstock with a diameter ranging from 9 ft to 14.5 ft. The tunnel and penstock have a maximum flow capacity of 3,500 cfs (Figure 4.1-1).

11. New Colgate Powerhouse and Switchyard, an aboveground, steel reinforced, concrete powerhouse located adjacent to the Yuba River. The powerhouse contains two Voith Siemens Pelton type turbines with a total actual measured capacity of 340 MW under a design head of 1,306 ft and a measured flow of 3,430 cfs. The New Colgate Switchyard is located adjacent to New Colgate Powerhouse. (Figure 4.1-3)

12. New Bullards Bar Reservoir Recreation Facilities, 16 recreation facilities, which include: 1) Hornswoggle Group Campground; 2) Schoolhouse Campground; 3) Dark Day Campground; 4) Cottage Creek Campground;[12] 5) Garden Point Boat-in Campground; 6) Madrone Cove Boat-in Campground; 7) Frenchy Point Boat-in Campground; 8) Dark Day Picnic Area; 9) Sunset Vista Point; 10) Dam Overlook; 11) Moran Road Day Use Area; 12) Cottage Creek Boat Launch;[13] 13) Dark Day Boat Launch, including the Overflow Parking Area; 14) Schoolhouse Trail; 15) Bullards Bar Trail;[14] and 16) floating comfort stations. All of the recreation facilities are located on NFS land, with the exception of the Dam Overlook, Cottage Creek Boat Launch and small portions of the Bullards Bar Trail, which are located on land owned by YCWA. All of the developed recreation facilities are located within the existing FERC Project Boundary, except for a few short segments of the Bullards Bar Trail to the east of the Dark Day Boat Launch.

[12] Cottage Creek Campground was burned in 2011 and has not been rebuilt. YCWA is in discussions with the Forest Service regarding rebuilding the burned campground.
[13] Emerald Cove Marina provides visitor services at Cottage Creek Boat Launch, including houseboat and boat rentals, boat slips and moorings, fuel and a general store. The marina is operated under a lease from YCWA by a private company.
[14] The Project recreation facilities included one campground that is no longer part of the Project. Burnt Bridge Campground was closed initially by the Forest Service in 1979 due to low use levels. FERC, in an August 19, 1993 Order, which approved YCWA's Revised Recreation Plan, directed YCWA to remove all improvements and restore the Burnt Bridge Campground to the condition it was in prior to development of the facility. YCWA consulted with the Forest Service and all that remains of Burnt Bridge Campground today is the circulation road and vehicle spurs; all other facilities were removed.

13. Streamflow Gages, three streamflow gages, one each located downstream of Our House Diversion Dam (United States Geological Survey [USGS] Gage 11408880), downstream of Log Cabin Diversion Dam (USGS Gage 11409400), and downstream of New Bullards Bar Dam (USGS Gage 11413517).

14. Roads, 24 Primary Project Road segments for a total length of 7.22 mi, and 9 recreation-related road segments for a total length of 2.78 mi (Exhibit A).

4.1.1.1 New Bullards Bar Minimum Flow Development

The New Bullards Bar Minimum Flow Development consists of the following facilities and features:

1. New Bullards Minimum Flow Powerhouse Penstock, a 70-ft long, 12-in diameter steel penstock with a maximum flow capacity of 6 cfs (Figure 4.1-3). The penstock bifurcates off the New Bullards Bar Dam low level out upstream of the 72-in Hollow Jet Valve.

2. New Bullards Minimum Flow Powerhouse, a single Pelton turbine with a capacity of 150 kW at a flow of 5 cfs (Figure 4.1-3).

3. New Bullards Minimum Flow Transformer, a transformer located adjacent to the New Bullards Minimum Flow Powerhouse.

The New Bullards Bar Minimum Flow Development does not include any recreation facilities, streamflow gages,[15] Primary Project Roads or recreation roads.

4.1.1.2 Narrows 2 Development

The Narrows 2 Development consists of the following features:

1. Narrows 2 Powerhouse Penstock, a tunnel that is 20 ft in diameter and concrete lined in the upper 376 ft, and 14 ft in diameter and steel lined for the final 371.5 ft. The penstock has a maximum flow capacity of 3,400 cfs. Figure 4.1-4 provides a longitudinal schematic of the Narrows 2 Powerhouse Penstock and Powerhouse.

2. Narrows 2 Full Bypass, a valve and penstock branch off the Narrows 2 Penstock, which can discharge up to 3,000 cfs of water at full head into the Yuba River immediately upstream of the Narrows 2 Powerhouse through a 72-in diameter fixed-cone valve. The full bypass was installed in 2008 to maintain minimum flows during times of full shutdown of the Narrows 2 Powerhouse (Figure 4.1-4).

[15] The New Bullards Bar Minimum Flow Development does not include any streamflow or reservoir gages. However, YCWA uses USGS Gage 11413517, North Yuba River Downstream from New Bullards Bar Dam, listed under the New Colgate Development, to measure releases from the New Bullards Bar Minimum Flow Powerhouse.

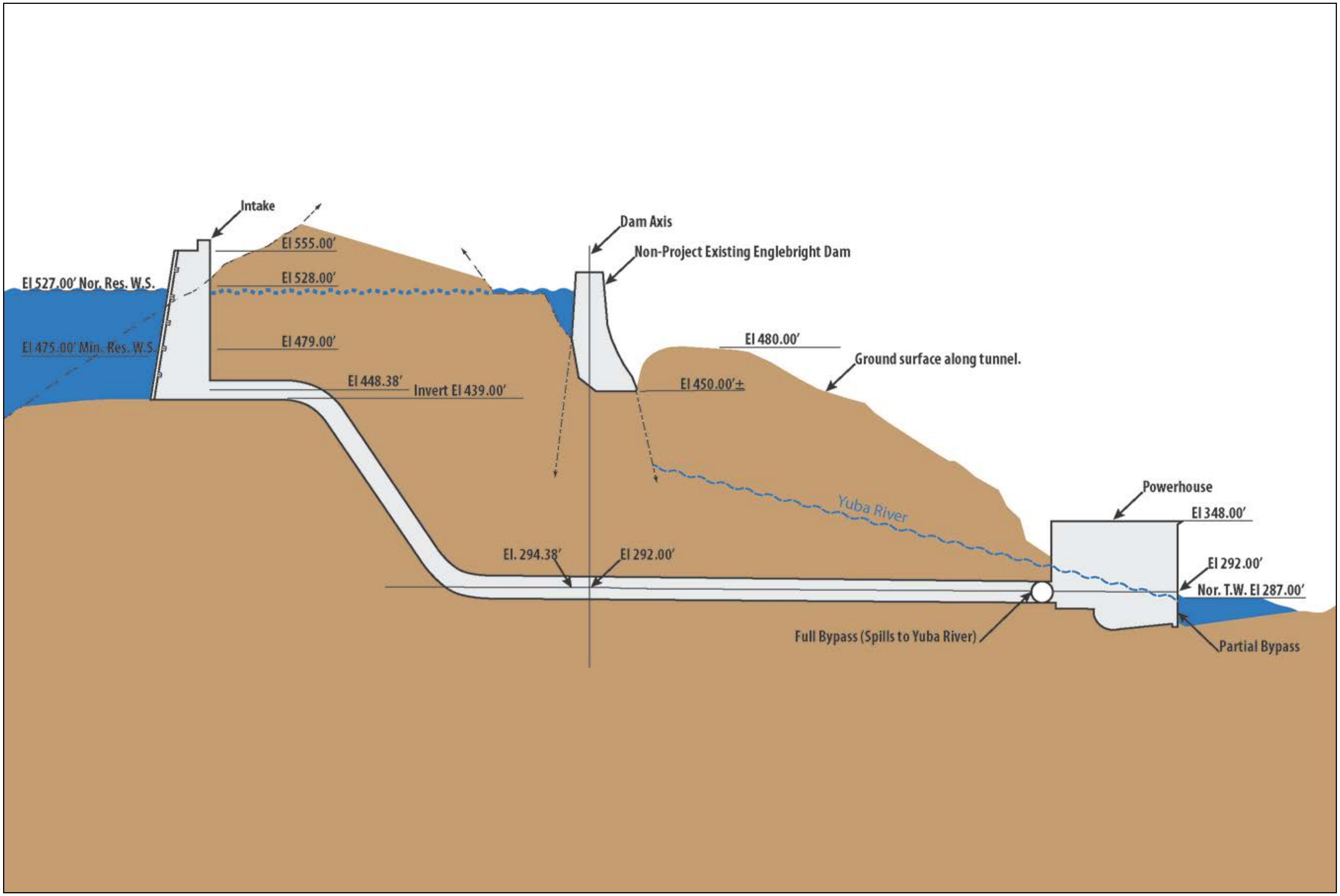

Figure 4.1-4. Longitudinal schematic of Narrows 2 Powerhouse Penstock and Powerhouse.

3. Narrows 2 Powerhouse and Switchyard, an indoor powerhouse located about 200 ft downstream of Englebright Dam. The powerhouse consists of one vertical axis Francis turbine with a capacity of 55 MW at a head of 236 ft and flow of 3,400 cfs. The powerhouse includes a pipe off the Narrows 2 Powerhouse turbine scroll case, which can discharge up to 650 cfs of water at full head into the Yuba River through a 36-in valve located on the downstream face of the powerhouse above the draft tube outlet. This Partial Bypass was built as part of the original design when the Narrows 2 Powerhouse was constructed, and normally releases no more than about 300 cfs (i.e., the Full Bypass is used for higher flow releases). The Narrows 2 Powerhouse Switchyard is located adjacent to the powerhouse.

4. Roads, 6 Primary Project Road segments for a total length of 2.48 mi (Exhibit A).

The Narrows 2 Development does not include any streamflow gages,[16] recreation facilities or recreation roads.

4.1.2 Existing Project Boundary

The FERC Project Boundary is intended to consist of all lands necessary for the safe operations and maintenance of the Project and other purposes, such as recreation, shoreline control, and protection of environmental resources. For the Yuba River Development Project, the existing boundary encompasses 7,815.3 ac of land in Yuba, Nevada and Sierra counties, California. The existing FERC Project Boundary includes a zone of area that encloses all Project facilities and features. The width of the zone around a facility or feature varies depending on the type of Project facility or feature and the activities associated with it.

A total of 55.1 percent of the land (4,306.3 ac) within the FERC Project Boundary is NFS land, and 0.2 percent (16.1 ac) is Corps land. Three-tenths percent of the land (20.1 ac) is State of California-owned land. YCWA owns 41.7 percent of the land (3,258.6 ac) within the existing boundary. The remaining 2.7 percent of the land (214.3 ac) within the existing FERC Project Boundary is in private ownership.

4.1.3 Existing Project Safety

The Project has been operating for more than 45 years under the existing license and during this time FERC staff has conducted operational inspections focusing on the continued safety of the structure, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, the Project has been inspected and evaluated every 5 years by an independent consultant and a consultant's safety report has been submitted for FERC's review. YCWA has a strong commitment to

[16] The Narrows 2 Development does not include any streamflow gages. However, YCWA uses data from two USGS existing streamflow gages on the Yuba River to document compliance with existing minimum streamflow requirements. These gages are Gage 11418000 (at Smartsville) and Gage 11421000 (at Marysville).

employee and public safety, which is reflected in its written safety procedures and training program, and its safety record.

4.1.4 Existing Project Operations

One of YCWA's major considerations each year is anticipated water availability. YCWA begins estimating water availability each year in January and continually updates the estimate throughout the spring runoff period. When estimating available water supply, YCWA considers current reservoir storage and California Department of Water Resources (CDWR) Bulletin 120 forecasts of unimpaired flow at the Smartsville gage on the lower Yuba River and the Goodyears Bar gage on the North Yuba River. Estimates of available water supply and other water needs are compared to estimates of required releases, consumptive demands within YCWA, and target levels for fall carryover storage in New Bullards Bar Reservoir.

Typically, YCWA operates New Bullards Bar Reservoir by capturing winter and spring runoff from rain and snowmelt. The North Yuba River inflow to New Bullards Bar Reservoir is augmented by diversions from the Middle Yuba River to Oregon Creek through the Lohman Ridge Tunnel, and by diversions from the Lohman Ridge Tunnel and Oregon Creek into the reservoir through the Camptonville Tunnel.[17] Consequently, New Bullards Bar Reservoir normally reaches its peak storage at the end of the spring runoff season, and then is gradually drawn down until its lowest elevation in early to mid-winter. The reservoir does not undergo significant daily changes in elevation.

New Bullards Bar Reservoir has mandatory reserved flood storage space criteria from mid-September through the end of May that limit maximum authorized storage (See Section 4.1.5.1). The Our House and Log Cabin diversion dam impoundments have no appreciable storage, and YCWA operates them exclusively to divert water to New Bullards Bar Reservoir in the winter and spring during high flow periods.

In the spring of each year, YCWA makes a determination of anticipated runoff into New Bullards Bar Reservoir relying upon snow course measurements and forecasts of runoff provided by CDWR. YCWA also makes estimates of water needs for local water deliveries and for releases to meet required instream flows for the current water year (WY). Based on these forecasts, an end-of-September storage is estimated. If the forecasted end-of-September storage is higher than a pre-determined target (650,000 ac-ft),[18] releases are increased above the required flows to draw reservoir storage down to the target level. The target storage is an operational measure used to drive releases in relatively wet years.[19]

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[17] The average total inflows to New Bullards Bar Reservoir from the North Yuba River and diversions from the Middle Yuba River and Oregon Creek are about 1,200,000 ac-ft per year, and annual inflow has ranged from a low of 163,000 ac-ft in 1977 to a high of 2,800,000 ac-ft in 1982.

[18] An end-of-September storage of 650,000 ac-ft would ensure adequate storage to meet full irrigation demands and dry-year flow requirements for a 99 percent exceedance drought in the following year.

[19] The end-of-September target storage drives New Bullards Bar Reservoir operations in 56 percent of years under the Base Case scenario.

In addition to the target storage, there is a carryover storage requirement for drought protection purposes. If forecasted end-of-September storage falls below an end-of-September carryover storage requirement, agricultural deliveries may be reduced to ensure adequate water supply for the following year. Reservoir carryover storage is used to make up the difference between the available surface water supply and system demands (e.g., diversion demands, instream flow requirements, and system operational losses) under drought conditions.

In wetter years YCWA operates New Bullards Bar Reservoir to an end-of-September target storage level for the Lower Yuba River Accord of 650,000 ac-ft, as well as other target storage levels for various times in mid-winter that are parts of power generation operations and flood control operations.

The New Bullards Bar Minimum Flow Powerhouse is operated as a "*base load*" facility where flows are set at a constant rate to provide the required instream flows downstream of New Bullards Bar Dam.

The New Colgate Powerhouse is a highly versatile facility, and is used for a combination of peaking and base generation. Depending upon energy demand, the New Colgate Powerhouse generation can be fluctuated in less than 10 minutes from a minimum of 1 MW with only one unit operating to maximum load of 340 MW with both units operating, if both units are ramped up at the same time. This ability to rapidly fluctuate generation, together with substantial storage available in New Bullards Bar Reservoir, makes the New Colgate Powerhouse important and unique to the Northern California power grid.

For most of the year, New Colgate Powerhouse is operated as a peaking facility, or to provide ancillary services such as spinning reserves or regulation. Under peaking operations, releases through the powerhouse are concentrated to hours of the day when power is most valuable or when power is needed most (such as weekdays from mid-morning through early evening, largely corresponding to warmer times of the day and/or peak workday and early evening hours). Under ancillary services operations, the generating station is ramped upwards or downwards quickly, to respond to power system load changes on a near-real-time basis, and generating station output and flows may vary substantially minute-to-minute. The New Colgate Powerhouse also often operates under a combined peaking/ancillary service protocol, with one unit operating in peaking mode and the other unit responding to ancillary service requirements. During some of the late 1990s and early 2000s, New Colgate Powerhouse operations were focused on weekday peak generation. More recently, power generation has shifted to a schedule driven by a balance of peak period generation and providing ancillary services to the region.

At many times, New Colgate Powerhouse provides a significant percentage of the required ancillary service for grid regulation of the region, as dispatched by the California Independent System Operator (ISO), the entity responsible for maintaining grid reliability in California. Peaking operations dominate power generation operations at New Colgate Powerhouse. However, under high flow conditions, some or all of the available capacity is used for base load generation, generating inexpensive power while excess water must be moved through the system anyway.

Table 4.1-3 provides a summary of the typical historical flow range of operations through the Narrows 1 Powerhouse, Narrows 2 Powerhouse, the Narrows 2 partial bypass and the Narrows 2 full bypass. Because of the higher efficiency of the Narrows 1 Powerhouse at lower flows and the fact that releases through the Narrows 1 Powerhouse result in energy generation that qualifies for California Renewable Portfolio Standard (RPS) credit and revenue and PG&E is required to meet a certain percentage of its total generation through RPS, PG&E prefers at certain times and under certain energy market conditions to run Narrows 1 Powerhouse and to bypass flows at the Narrows 2 Powerhouse. Because PG&E receives all power generated by both powerhouses, and because PG&E's payments to YCWA under the existing power purchase contract are not affected by the relative amounts of power generated by the two powerhouses, YCWA has agreed with PG&E's decisions regarding the coordinated operation of the two powerhouses. These coordinated operations may change after April 30, 2016, when the term of the existing power purchase contract with PG&E ends.

Table 4.1-3. Typical distribution of flow under normal operations (i.e., excluding brief change-over periods) among Narrows 1 Powerhouse, Narrows 2 Powerhouse, Narrows 2 Partial Bypass and Narrows 2 Full Bypass. Normally, for Narrows 2 Powerhouse, Partial Bypass and Full Bypass, only one operates at a time, excluding brief change-over periods.

Range of Flow Releases to Yuba River[1] (cfs)	Narrows 1 Powerhouse Release (cfs)	Narrows 2 Powerhouse Release[2] (cfs)	Narrows 2 Partial Bypass[2] (cfs)	Narrows 2 Full Bypass[2] (cfs)	Englebright Dam Spill (cfs)
Up to 730	150 - 730	0	Up to 100 cfs	>100 cfs Used to Supplement Narrows 1 Powerhouse Flow to Meet Minimum Flows	0
730 - 900	730	0	Up to 100 cfs	>100 cfs Used to Supplement Narrows 1 Powerhouse Flow to Meet Minimum Flows	0
900 - 1,6301	Up to 730	700 – 1,630	Typically not used	Used When Narrows 2 Powerhouse not available	0
1,630 - 3,4001	Up to 730	700 - 3,400	Typically not used	Used When Narrows 2 Powerhouse not available	0
3,400 - 4,130	Up to 730	2,670 – 3,400	Typically not used	0	0
> 4,130	Up to 730	3,400	Typically not used	0	All remaining flow

1 The use of the Narrows 1 Powerhouse in this range is dependent on a number of economic factors and can vary from no flow to the maximum Narrows 1 Powerhouse capacity. In this range Narrows 2 alone or Narrows 1 with Narrows 2 may operate.
2 The typical operating flow ranges of Narrows 2 facilities are limited by long-term reliability considerations, such as vibration and cavitation of runners; and are as follows: the Narrows 2 Powerhouse between 700 and 3,400 cfs (although occasionally as low as 600 cfs); the Partial Bypass between 0 and 100 cfs (although occasionally as high as 400 cfs); and the Full Bypass between 100 and 3,000 cfs.

Figure 4.1-5 shows mean daily flow through Narrows 1 and 2 Powerhouses and Narrows 2 Full Bypass since 2008 when the bypass was put into operation.[20]

[20] Prior to construction of the Narrows 2 Powerhouse Full Bypass, YCWA had the ability to pass some water through the powerhouse when it was not operating.

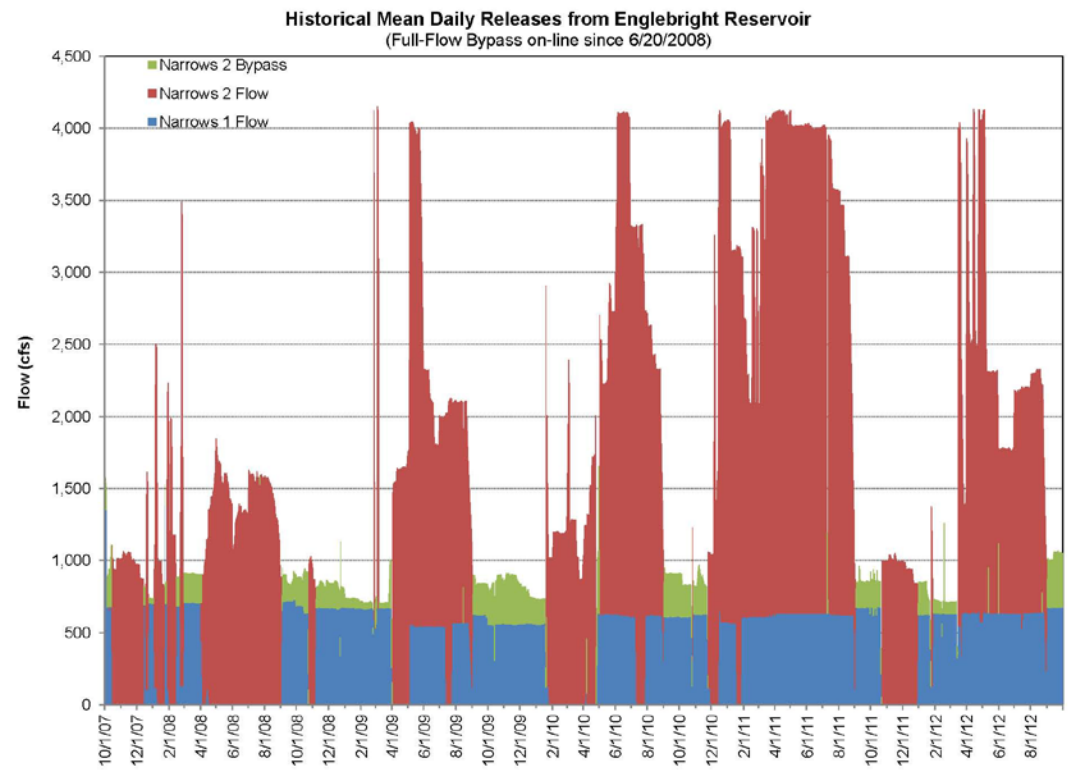

Figure 4.1-5. Flows through Narrows 1 Powerhouse, Narrows 2 Powerhouse and Narrows 2 Powerhouse Full Bypass from WY 2008 through WY 2011.

Use of the Partial Bypass is infrequent. From December 22, 2009 through April 10, 2012, YCWA operated the partial bypass during five events: twice in 2010 and twice in 2012. The partial bypass was not used in 2011.[21] Since installation of the full bypass, the partial bypass is typically only used for a few specific reasons, which include: 1) maintenance on the full bypass when generation is not possible; 2) obtaining foot access above the full bypass when generation is not possible; and 3) supplemental flow releases generally less than 100 cfs. Low-flow release below 100 cfs is not a hard rule, but the full bypass is switched over to the partial bypass if vibrational noise begins to occur at lower flows through the full bypass, which generally occur when less than 100 cfs is released.

[21] In addition, the partial bypass was opened on October 25, 2012 to accommodate a relicensing study. This is not listed as one of the events because it was related to relicensing, not normal Project operations.

4.1.5 Existing Environmental Measures

4.1.5.1 Measures in Current FERC License

The existing FERC license includes 60 articles. Of these, YCWA considers 19 articles (articles 28, 29, 30, 35, 36, 41, 42, 43, 44, 48, 50, 51, 52, 58, 60, 62, 65, 66, and 67), "expired" or "*out of date*" because each pertains to a construction activity that has been completed, a filing related to a construction activity that has been completed, or another activity that has been completed. As a result, the existing license contains 41 "*active*" articles. Of these, Articles 33, 34, 40, and 46 are more germane to Project operations than the other 37 articles. Each of these is provided below as it appears in the existing FERC License.

Article 33. The Licensee shall maintain the following minimum streamflow schedules for maintenance of fish life in the several streams listed:

(a)

(a) Stream	Flow (cfs)[1]	
	April 15 to June 15	June 16 to April 14
Middle Yuba (below Hour House Diversion)	50	30
Oregon Creek (below Log Cabin Diversion)	12	8
North Yuba (below New Colgate Diversion)	5	5

[1] Or natural flow, whichever is less. Maximum 24-hour fluctuations of plus or minus 10 percent are permitted for flows in Middle Yuba below Hour House Diversion and in Oregon Creek below Log Cabin Diversion.

(b)

(b) Stream	Flow (cfs)[1]			Measurement Point
	Jan. 1 to Jun. 30	Jul. 1 to Sept. 30	Oct. 1 to Dec. 31	
Yuba River (below Daguerre Dam)	245	70	400	Over the crest of Daguerre Point Dam and through fishway

1 Provided that these flows shall be in addition to releases made to satisfy existing downstream water rights.

(c)

Water releases for fish life as specified in paragraphs (a) and (b) of this article shall be subject to the following reduction in any critical dry year, defined as a water year for which the April 1 forecast of the California Department of Water Resources predicts that streamflow in the Yuba River at Smartsville be 50 percent or less of normal:

Yuba River at Smartsville streamflow forecast percent of normal	Reduction in Water Releases for Fish Life, Percent
50	15
45	20
40 or less	30

However, in no event shall releases for fish life below Daguerre Point Dam be reduced to less than 70 cfs. The critical dry year provisions herein shall be effective from the time the aforesaid forecast is available until the April 1 forecast of the following year.

(d)
In addition to maintaining winter minimum water releases for fish life in Yuba River below Daguerre Point Dam, as specified in paragraphs (b) and (c) of this article, the Licensee shall maintain uniform and continuous releases from Englebright Dam within the limits of the following schedule:

Period	Releases (cfs)1	Measurement Point
Oct. 16 to 31	600-1,050	New gaging station to be built downstream from the two Narrows powerhouses.
November	600-700	
December	600-1,400	
Jan. 1 to 15	1,000-1,850	
Jan. 16 to Mar. 31	600	

Provided that:

A. Variations from this schedule are permissible during emergencies, uncontrollable flood flows, and critical dry year curtailments.

B. With the exception of emergencies, releases required by U.S. Army Corps of Engineers flood control criteria, releases required to maintain a flood control buffer or for other flood control purposes, bypasses of uncontrolled flows into Englebright Reservoir, uncontrolled spilling, or uncontrolled flows of tributary streams downstream of Englebright Dam, Licensee shall make reasonable efforts to operate New Bullards Bar Reservoir and Englebright Reservoir to avoid fluctuations in the flow of the lower Yuba River downstream of Englebright Dam, and daily changes in project operations affecting releases or bypasses of flow from Englebright Dam shall be continuously measured at the USGS gage at Smartsville, and shall be made in accordance with the following conditions:

i. Project releases or bypasses that increase streamflow downstream of Englebright Dam shall not exceed a rate of change of more than 500 cfs per hour.

ii. Project releases or bypasses that reduce streamflow downstream of Englebright Dam shall be gradual and, over the course of any 24-hour period, shall not be reduced below 70 percent of the prior day's average flow release or bypass flow.

iii. Once the daily project release or bypass level is achieved, fluctuations in the streamflow level downstream of Englebright Dam due to changes in project operations shall not vary up or down by more than 15 percent of the average daily flow.

iv. During the period from September 15 to October 31, the licensee shall not reduce the flow downstream of Englebright Dam to less than 55 percent of the maximum five-day average release or bypass level that has occurred during that September 15 to October 31 period or the minimum streamflow requirement that would otherwise apply, whichever is greater.

v. During the period from November 1 to March 31, the licensee shall not reduce the flow downstream of Englebright Dam to less than the minimum streamflow release or bypass established under (iv) above; or 65 percent of the maximum five-day average flow release or bypass that has occurred during that November 1 to March 31 period; or the minimum streamflow requirement that would otherwise apply, whichever is greater.

Article 34. The Licensee shall maintain a minimum pool in New Bullards Bar Reservoir at Elevation 1,730 ft.

Article 40. Consistent with the primary purpose of the power intakes in the New Bullards Bar Dam, the Licensee shall operate, within limits of the project, the multiple-level power intakes in New Bullards Dam to provide water of suitable quality in the Yuba River downstream from the New Narrows Power Plant for the production of anadromous fish as may be prescribed by the Commission upon the recommendations of the Director of the CDFG and the USFWS.

> **Article 46**. The Licensee shall operate the project reservoirs for flood control in accordance with rules prescribed by the secretary of the Army, such rules to be specified in a formal agreement between the Licensee and the District Engineer, U.S. Army Engineers District, Sacramento, California. Said agreement shall be subject to review from time to time at the request of either party; provided, however, that a different procedure of review may be prescribed by formal agreement.

With regards to Article 46, YCWA operates New Bullards Bar Reservoir from September 16 to May 31 to comply with Part 208 "*Flood Control Regulations, New Bullards Bar Dam and Reservoir, North Yuba River, California*," pursuant to Section 7 of the Flood Control Act of 1944 (58 Stat. 890). Under the contract between the United States and YCWA that was entered into on May 9, 1966, YCWA agreed to reserve in New Bullards Bar Reservoir 170,000 ac-ft of storage space for flood control in accordance with rules and regulations enumerated in Appendix A of the Report on Reservoir Regulation for Flood Control (USACE 1972). The seasonal flood storage space allocation schedule is presented in Table 4.1-4 (specified values are for the end of each month).

Table 4.1-4. New Bullards Bar Reservoir flood storage space allocation in thousands of acre-ft.

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Storage Allocation	170	170	170	170	170	170	70	0	0	0	0	56

In addition to reservation of flood control space in New Bullards Bar Reservoir, the flood control regulations include rules governing ramping rates as well as target maximum flows in the Yuba River downstream of Englebright Dam and in the Feather River downstream of the confluence with the Yuba River.

YCWA also coordinates operations with PG&E's Narrows 1 Powerhouse downstream of Englebright Dam to use storage in Englebright Reservoir to capture winter storm freshets and reduce storm flows on the Yuba River. This operation is accomplished by evacuating storage space in Englebright Reservoir in anticipation of storm peak flows.

4.1.5.2 Measures in Other Licenses, Agreements and Contracts that Affect Operations

In addition to the current FERC license requirements, licenses, agreements and contracts include various streamflow-related requirements, which are summarized below. These licenses, agreements and contracts, and terms and conditions in them, affect Project operations, but are not part of the existing FERC license.

4.1.5.2.1 Lower Yuba River Accord (no expiration date in SWRCB Corrected Order Water Right 2008-0014)

As stated above, YCWA has operated the Project in compliance with the Yuba Accord since 2006. Please see Section 2.3.1 in Exhibit E of the Application for New License for description of the lower Yuba River Accord.

4.1.5.2.2 YCWA's Water Rights for Power (No Expiration Date)

YCWA holds pre-1914 appropriative rights dating from 1897 and post-1914 appropriative water rights confirmed by water-right licenses, for the purposes of operating the Project for hydroelectric power generation. Table 4.1-5 lists the post-1914 appropriative water-right licenses held by YCWA for power generation.

Table 4.1-5. Water right licenses held by YCWA for operation of the Project for power generation.

Priority (date)	SWRCB Designation (application)	SWRCB Designation (license)	Source (Waterbody)	Amount & Place of Diversion or Storage (amount & place)		Season (period)		Place of Beneficial Use (powerhouse)
2/11/1921	2197	435	North Yuba River	700 cfs at New Bullards Bar Dam		1/1 - 12/31		New Colgate Powerhouse
				5,000 ac-ft/yr at New Bullards Bar Dam		about 12/15 to about 7/15		
9/7/1922	3026	436	North Yuba River	10,000 ac-ft/yr at New Bullards Bar Dam		about 12/15 to about 7/15		New Colgate Powerhouse
4/30/1926	5004	777	North Yuba River	15,000 ac-ft/yr at New Bullards Bar Dam		about 12/15 to about 7/15		New Colgate Powerhouse
7/30/1927	5631	11565	Middle Yuba River	810 cfs at Our House Dam	490,000 ac-ft/yr storage in New Bullards Bar Res	1/1-12/31 (dir. div.)	10/15 to 6/30 (stor.)	New Colgate Powerhouse and Narrows 2 Powerhouse
			Oregon Creek	240 cfs at Log Cabin Dam		1/1-12/31 (dir. div.)		
			North Yuba River	1,800 cfs at New Bullards Bar Dam		11/1-7/31 (dir. div.)		
			Yuba River	1,800 cfs at USACE's Englebright Dam		1/1- 12/31		
3/1/1939	9516	3050	North Yuba River	100 cfs at New Bullards Bar Dam		1/1 - 12/31		New Colgate Powerhouse
9/12/1941	10282	5544	North Yuba River	5,335 ac-ft/yr at New Bullards Bar Dam		about 10/1 to about 3/1		New Colgate Powerhouse
								Narrows 2 Powerhouse
2/20/1953	15205	11566	Middle Yuba River	3,200 ac-ft/yr at Log Cabin Dam; storage in New Bullards Bar Res.		5/1- 6/30		New Colgate Powerhouse and Narrows 2 Powerhouse
			North Yuba River	245 cfs and 700 ac-ft/yr at New Bullards Bar Dam		3/15- 6/15 (dir. div.); 5/1- 6/30 (stor.)		
			Yuba River	800 cfs at USACE's Englebright Dam		11/1-7/15		
10/2/1953	15563	11567	Middle Yuba River	30,000 ac-ft/yr at Our House Dam	all storage in New Bullards Bar Res.	10/15 - 6/30		New Colgate Powerhouse and Narrows 2 Powerhouse
			Oregon Creek	1,400 ac-ft/yr at Log Cabin Dam		10/15 - 6/30		
			North Yuba River	146,000 ac-ft/yr at New Bullards Bar Dam		10/15 - 6/30		
			Yuba River	910 cfs at USACE's Englebright Dam		11/1 - 6/30		

YCWA operates the Project consistent with the terms and conditions of the above water rights.

4.1.5.2.3 1965 Cal Fish and Game Agreement (has been fully implemented)

On September 2, 1965, YCWA and the California Department of Fish and Game (i.e., now Cal Fish and Wildlife) entered into an agreement regarding the Project. This agreement specifies the Project minimum flow requirements that subsequently were adopted in Article 33 of the FERC license and YCWA's water-right permits. While this agreement does not have a termination date, it was fully implemented when the Commission adopted Article 33 and the SWRCB included the agreement's provisions in YCWA's water-right permits.

4.1.5.2.4 Water Supply Deliveries

Within the Project Area, YCWA pumps some water directly from New Bullards Bar Reservoir to supply water to the Cottage Creek Water Treatment Plant for domestic and recreational uses adjacent to the reservoir. The amount of this pumping averages approximately 6 ac-ft per year, which does not affect Project operations. YCWA anticipates that pumping of this small amount of water will continue during the period of the new license.

Downstream of the Project, water is diverted under YCWA's consumptive-use water-right permits to eight water users, which are collectively referred to as the YCWA Member Units. The places of water delivery to YCWA's Member Units are listed in Table 4.1-6. The YCWA Member Unit service areas are shown in Figure 4.1-6.

Table 4.1-6. YCWA's annual contract amounts and place of delivery.

Member Unit	Base Contract (ac-ft)	Supplemental Contract (ac-ft)	Total Contract (ac-ft)	Member Unit Water Rights (ac-ft)	Total Contract and Water Rights (ac-ft)
BROWNS VALLEY IRRIGATION DISTRICT PUMPLINE DIVERSION FACILITY					
Browns Valley Irrigation District[1]	9,500	--	9,500	24,4621	33,962
SOUTH CANAL[2]					
Brophy Water District	43,470	32,177	75,647	--	75,647
South Yuba Water District	25,487	18,843	44,330	--	44,330
Dry Creek Mutual Water Company[2]	13,682	3,061	16,743	--	16,743
Wheatland Water District[3]	23,092	17,138	40,230	--	40,230
NORTH CANAL[4]					
Cordua Irrigation District	12,000	--	12,000	60,000	72,000
Hallwood Irrigation Company	--	--	--	78,000	78,000
Ramirez Water District	14,790	10,311	25,101	--	25,101
Total	142,021	81,530	223,551	162,462	386,013

1 BVID receives water at the Pumpline Diversion Facility, located 1 upstream from USACE's Daguerre Point Dam.
2 BWD, SYWD, DCMWC and WWD receive water from the South Yuba Canal (South Canal), which begins on the south side of the Yuba River slightly upstream of the south abutment of USACE's Daguerre Point Dam.
3 Includes both Phase 1 and Phase 2 of the Wheatland Project.
4 CID, HIC and RWD receive water through the Hallwood-Cordua Canal (North Canal), located on the north abutment of USACE's Daguerre Point Dam.

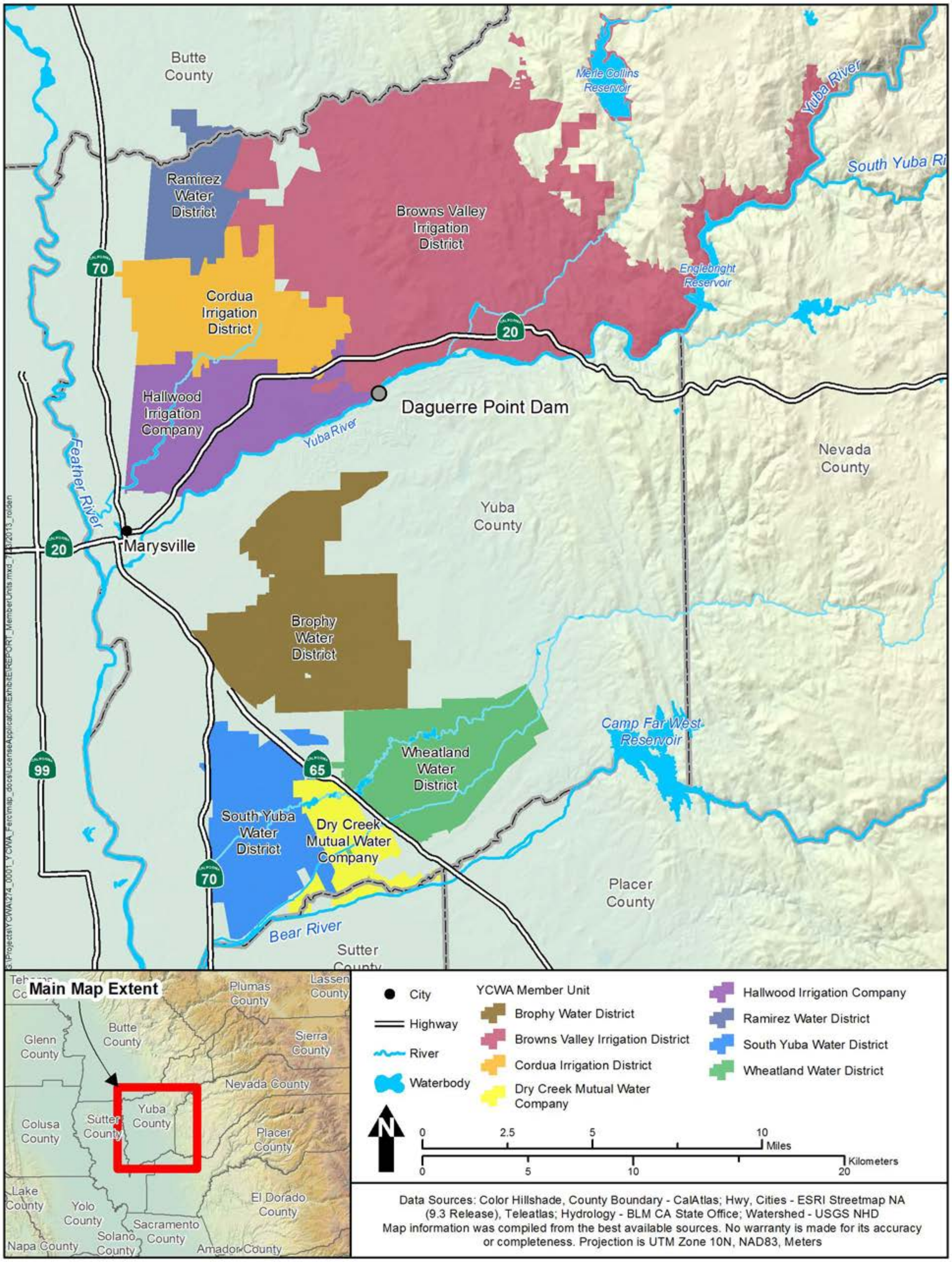

Figure 4.1-6. YCWA's Member Unit service areas.

BVID, CID, and HIC have their own water rights on the Yuba River. Under settlement contracts with YCWA, CID and HIC receive surface water supplies as part of Project operations. Dry year deficiency criteria in these contracts are different from the deficiency criteria in YCWA's contracts with other member units. Provisions in YCWA's water right settlement contracts preclude deficiencies in water right settlement deliveries unless CDWR April forecast of unimpaired runoff as measured at the Smartsville gage is less than 40 percent of average. No deficiencies in such deliveries may be imposed on BVID. Contract shortage provisions are presented in Table 4.1-7.

Table 4.1-7. YCWA's water supply contract shortage provisions.

Category	Unimpaired Runoff Forecast (f)[1]	Percentage of Settlement/ Contract Allocation Available
PRE-1914 RIGHTS SETTLEMENTS		
Base Project Water for Other Member Units	f > 85%	100%
	50% < f ≤ 85%	85%
	40% ≤ f ≤ 50%	70%
	f < 40%	50%
Browns Valley Irrigation District	All	100%
Cordua Irrigation District	f ≥ 40%	100%
Hallwood Irrigation Company	f < 40%	80%
YCWA SUPPLY CONTRACTS		
Supplemental Water	All forecasts	Determined annually by Licensee in its reasonable discretion considering forecasted runoff and operational conditions.

[1] April 1 CDWR forecast of unimpaired Yuba River runoff near Smartsville in percentage of 50-year average.

YCWA's contract allocations are based on the gross acreage served by each member unit. The maximum "*Base Project Water*" allocation is computed by multiplying 90 percent of the gross acreage by 2.87 ac-ft per acre. The maximum "*Supplemental Water Supply*" is computed by multiplying 90 percent of the gross acreage by 2.13 ac-ft per acre. For member units that have water rights senior to YCWA's, their contract allocations are based on their water right amounts.

In 2009, YCWA started providing water to the WWD under a water service contract. Until then, water users within WWD relied solely on groundwater for irrigation. The Wheatland Project now conveys surface water, diverted by YCWA at Daguerre Point Dam, to WWD through the South Canal system. The Wheatland Project is being constructed in two phases. Phase 1, which was completed in 2009, provides for delivery of surface water to WWD and the immediate irrigation of approximately 7,750 ac of the approximately 9,200 ac that will be served upon the completion of both phases. Under Phase 1, WWD's contract with YCWA provides for a total allocation (base and supplemental) of 23,092 ac-ft per year. When Phase 2 is completed, this contract will allow for a total allocation (base and supplemental) of 40,230 ac-ft per year.

4.1.5.2.5 Davis-Grunsky Agreement (Expires December 31, 2014)

On May 10, 1966, YCWA and the State of California entered into an agreement under the Davis-Grunsky Act regarding the Project. Among other provisions, this agreement requires YCWA to operate the Project to maintain the minimum flows specified in Articles 33 and 34 of the FERC license. The agreement was amended on August 14, 1973 and August 14, 2003. The term of the agreement ends on December 31, 2014.

4.2 YCWA's Proposed Project

Provided below is a description of YCWA's proposed Project. This section describes YCWA's proposed Project facilities (Section 4.2.1), 2) YCWA's proposed FERC Project Boundary (Section 4.2.2), 3) YCWA's proposed Project operations (Section 4.2.3), and 4) YCWA's proposed environmental measures that would be part of the new FERC license (Section 4.2.4).

4.2.1 Proposed Project Facilities

4.2.1.1 Generation Facilities

4.2.1.1.1 New Colgate Powerhouse Tailwater Depression System

YCWA proposes to add to the Project a new TDS at the New Colgate Powerhouse. The TDS will introduce compressed air into the turbine discharge chamber to lower the tailwater to a level that does not interfere with turbine operation, thereby allowing continued turbine operation during high flows. The TDS will thus enhance the ability to regulate flood releases from New Bullards Bar Reservoir and increase the production of energy.

Figure 4.2-1, 4.2-2 and 4.2-3 are conceptual-level plan and profile drawings of the New Colgate Powerhouse TDS. If approved, detailed drawings would be provided to the Commission as appropriate for FERC approval.

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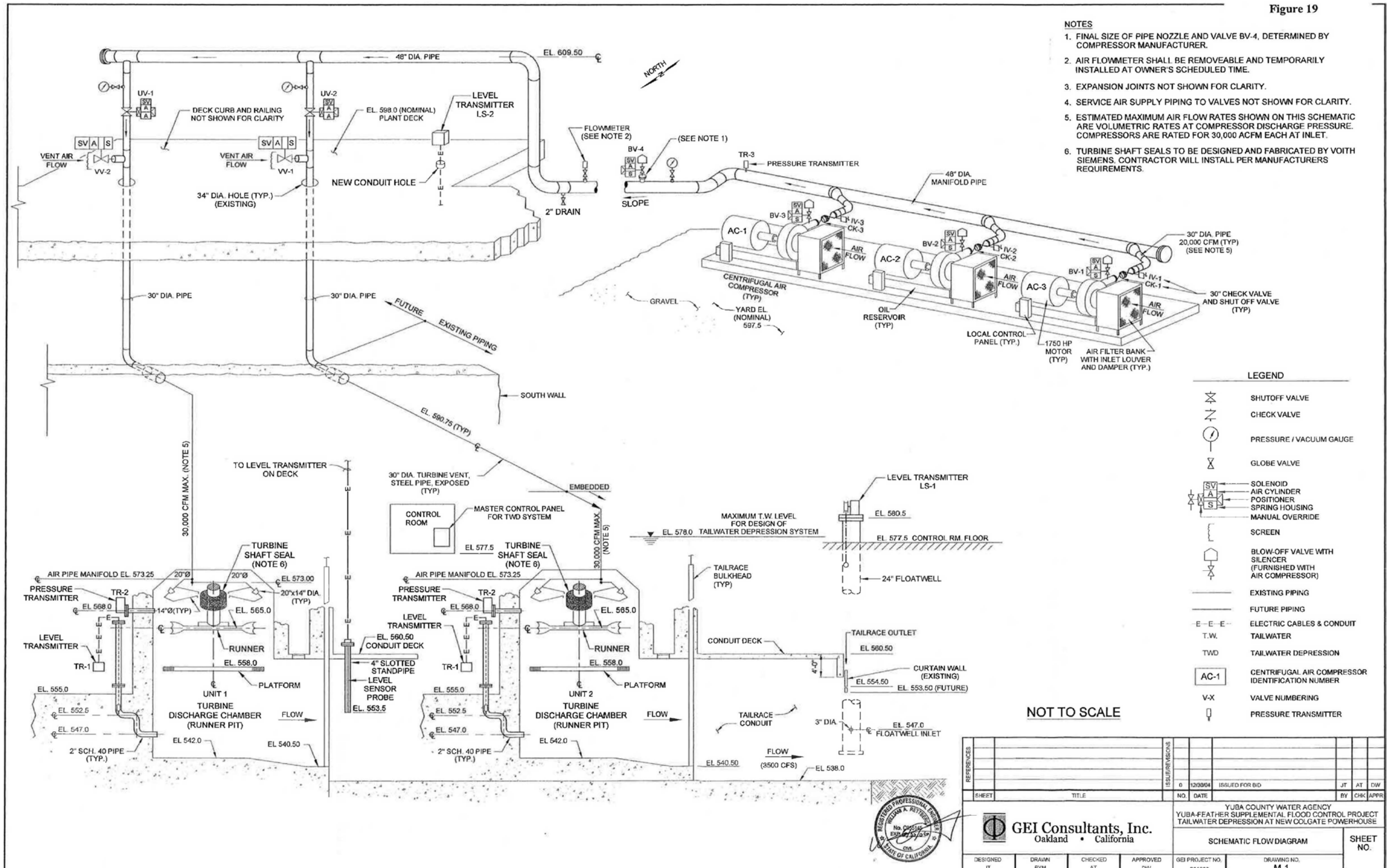

Figure 4.2-1. Schematic flow diagram for YCWA's proposed New Colgate Powerhouse TDS.

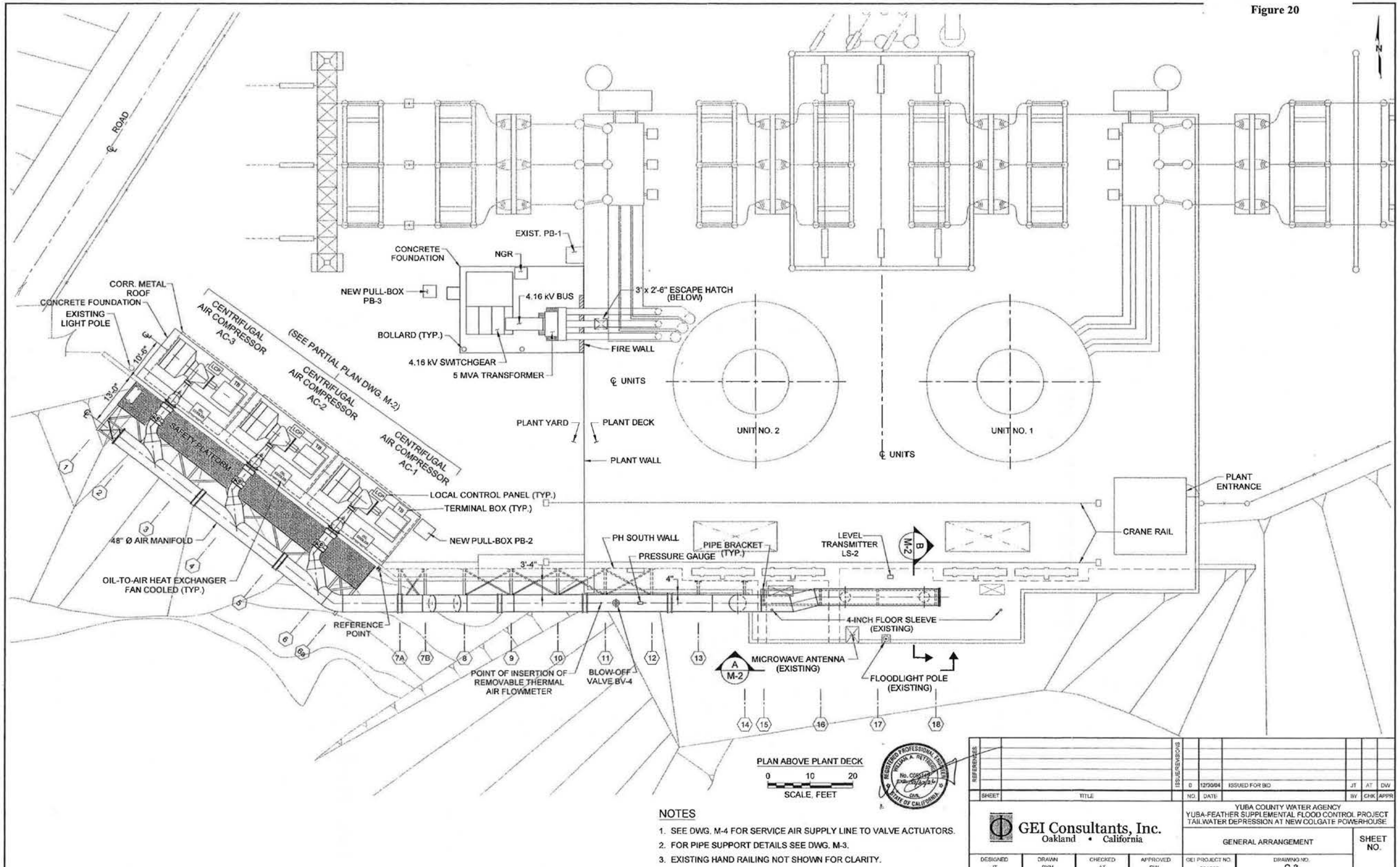

Figure 4.2-2. General arrangement for YCWA's proposed New Colgate Powerhouse TDS.

Figure 21

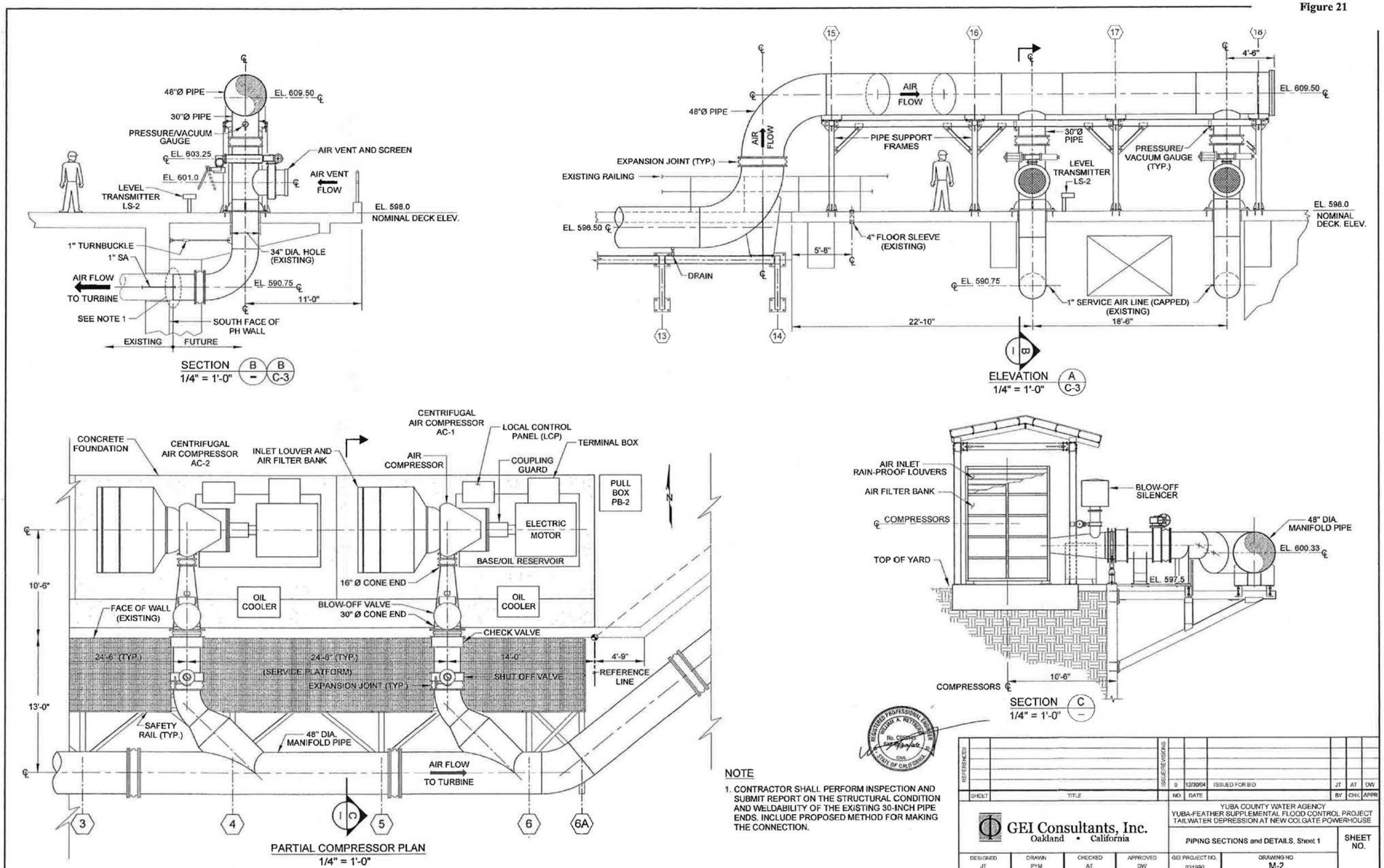

Figure 4.2-3. Piping sections and details for YCWA's proposed New Colgate Powerhouse TDS.

The anticipated total duration of the construction is 5 months, and YCWA anticipates that the work can be accomplished during planned outages. Key construction activities would include the following:

- Site preparation at powerhouse yard and deck, including construction of equipment foundations and relocation of the New Colgate Powerhouse pedestrian bypass
- Installation of blowers, pipe supports, roofing, air piping and valves
- Installation of power supply, including the tap of the 13.8-kilovolt (kV) isolated phase bus, transformer, switchgear and cables to the blowers
- Installation of turbine shaft seals
- Curtain wall modifications
- Installation of bulkhead shaft seal
- Installation of instrumentation and controls

System testing and startup including construction and removal of temporary test barrier

The construction labor force is estimated to average about 12 persons over the total construction period. Equipment will be transported to the powerhouse via Highway 20, Marysville Road, and Lake Francis Road, all of which are paved and suitable for the anticipated loads. It is anticipated that not more than 30 trailer ("*low boy*") truck roundtrips will be required to bring the blower skids, transformer, other electrical gear, pipe, structural steel and other heavy materials and equipment. About 15 to 20 truckloads of ready-mixed concrete may be needed for equipment pads, foundations and curbs. No changes in road conditions are anticipated as a result of the work.

At the site, typical heavy construction equipment will include an excavator (backhoe), an air compressor, one or two trucks, two truck-mounted cranes, pickup trucks, and miscellaneous equipment. Smaller equipment will include hoists and platforms, concrete placing and drilling equipment, a welding machine, pipe fitting equipment, and other miscellaneous equipment customary to the electrical, mechanical and structural crafts.

No borrow areas are anticipated to be required because the work does not entail significant earthwork. It is expected that the available space within the fenced plant area will be sufficient for laydown and staging of materials and equipment. All work will be confined to the powerhouse, yard and immediate vicinity. No undisturbed areas are anticipated to be disturbed as a result of the work.

YCWA does not propose to add to the Project any previously constructed, unlicensed water power structures or facilities, or any new generation facilities.

4.2.1.2 Non-Generation Facilities

4.2.1.2.1 New Bullards Bar Dam Flood Control Outlet

YCWA proposes to construct a new flood control outlet on New Bullards Bar Dam, to be located south of the existing New Bullards Bar Dam spillway centerline in the upper left abutment area of the dam. The primary benefit of the new flood control outlet is increased flood control. As configured at this time, the new outlet would have a discharge capacity at the bottom of the New Bullards Bar flood pool (El. 1,918 ft) and at the NMWSE (El. 1,956 ft) of approximately 66,000 cfs and 45,000 cfs, respectively. The outlet would include:

- An excavated approach channel to the intake structure, with right and left wing walls.
- A reinforced-concrete intake control structure at the end of the approach channel containing intake gates and hydraulic hoists. The intake would be a 70-foot-wide reinforced-concrete structure extending from the approach channel invert at elevation 1,865 ft to a deck at elevation 1,970 ft. It would be located in a rock excavation at the downstream end of the approach channel. The intake structure would have three 17-ft-wide, 30-ft-high gate openings separated by 4.5-ft wide concrete piers. The gates would be roller-type gates operated by hydraulic cylinders. The gates would be operated using hydraulic cylinders installed on the top deck.
- Intake area site works including a fenced, paved parking area adjacent to the intake structure deck, access to Marysville Road, and riprap erosion protection of the finished slopes.
- A 540-ft-long concrete-lined conveyance tunnel. The tunnel would be concrete-lined and horseshoe-shaped, with net opening dimensions of 25 ft in height by 26 ft in width.
- A concrete outlet structure including the tunnel outlet portal, a 60-ft-long open channel and 27-ft-long flip-bucket energy dissipater at the end of the open channel, which would deflect the discharging water jet away from the foundation area and toward the river canyon. The flip-bucket structure would be founded and bolted to rock to resist the hydrodynamic forces and vibrations. A cutoff would be provided to protect the flip bucket foundation from scour. The area between the flip bucket and the river would be cleared of all vegetation, overburden and loose weathered rock down to sound rock.
- A 2,900-ft-long construction access road from an existing forest road to the outlet structure.
- Power supply to the intake for operation and control of the gates.

Figure 4.2-4 shows conceptual-level plan and profile drawings of the new flood control outlet. If approved, detailed drawings would be provided to the Commission as appropriate for FERC approval.

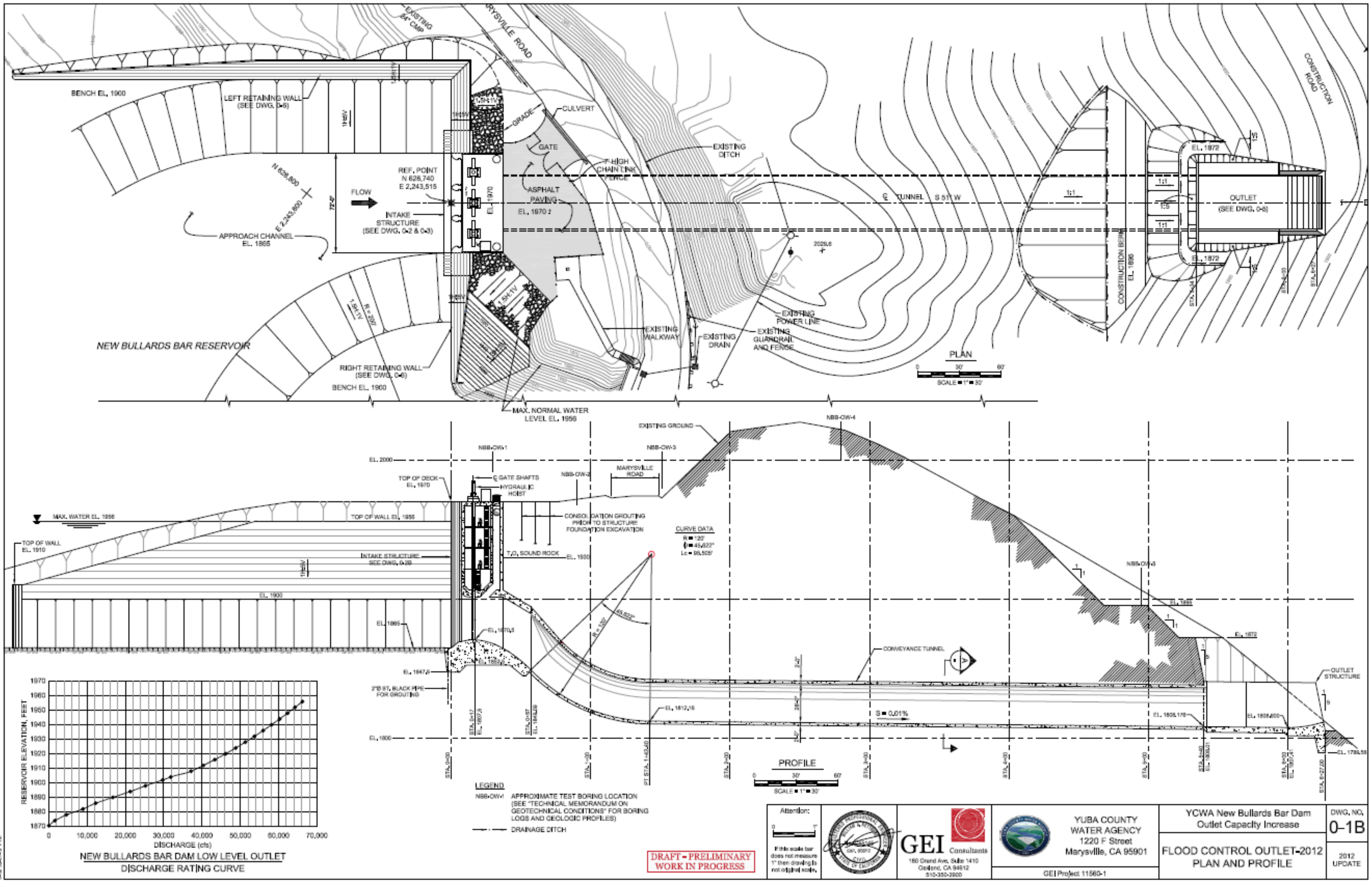

Figure 4.2-4. Conceptual level plan and profile for YCWA's proposed New Bullards Bar Dam flood control outlet.

Outlet construction would require excavation in the upper left abutment area of the dam site. To serve tunnel construction, a construction access road would be built from the left abutment area down to the outlet area. Tunnel construction would likely start from the downstream portal and would continue toward the upstream portal using conventional, staged and drill-and-blast excavation methods. Temporary tunnel support would be installed during excavation as needed.

It is anticipated that excavation for the intake structure would be performed concurrently with access road construction and/or tunnel excavation. A natural cofferdam (i.e., in-situ soil and rock) would be left in place in the inlet approach channel to protect the construction work and prevent uncontrolled release of reservoir water through the excavation area and tunnel. The natural cofferdam would likely need stabilization and buttressing measures to ensure the site is adequately protected from the reservoir.

After the concrete intake structure is completed, the over-excavated areas would be backfilled with structural fill, and riprap would be placed on the slopes that may be exposed to wave erosion.

The natural cofferdam would be left in place until the tunnel and intake structure are completed and the gates installed. Removal of the cofferdam and construction of the approach channel and inlet training walls would be performed during a low reservoir period (late summer/fall).

Work on all components of the project including the approach channel, intake structure, tunnel, and outlet structure, would be completed with only temporary disruptions of normal traffic patterns along Marysville Road due to movement of heavy construction equipment (e.g., excavators, haul trucks, concrete trucks and cranes). Some short duration (i.e., five- to 15-minute) road closures may be required when setting up or unloading large equipment.

Construction Laydown Areas

Laydown/staging areas are temporary facilities utilized during construction activities. Temporary construction facilities would likely include construction offices, worker and equipment parking, equipment maintenance yard, warehouse, fuel tank and fueling pad, aggregate processing plant, concrete batch plant including portable plant, bulk material silos (cement, fly ash), admixtures and aggregate piles, and temporary storage of other construction materials.

Potential laydown areas include: 1) east of visitor parking area adjacent to spillway on YCWA land (~4 ac); 2) flat area on north side of Marysville Road west of quarry on NFS land (~15 ac); 3) flat area on south side of Marysville Road south of quarry on private land (~20 ac); 4) southeast of dam along dirt forest road on YCWA land (~16 ac); 5) alongside Marysville Road, east of quarry on private land (~6 ac on YCWA and private land); 6) east side of Marysville Road, east of quarry on private land (1.5 ac on YCWA and private land); and 7) west side of parking area on right abutment on YCWA land (~2 ac).

Construction Disposal Areas

Disposal areas will be required for the permanent placement of excess excavated materials obtained during construction activities. Material placed in the disposal areas would consist of soil and rock from required excavation, including tunnel muck. Woody debris may also be placed in disposal areas. Material not suited for onsite disposal (e.g., petroleum products, trash and waste) would be hauled to an approved offsite disposal facility.

The estimated total quantity of excavated material, including an appropriate bulking factor, is approximately 300,000 cubic yards (cu yds). The materials obtained from required excavations would primarily consist of soil and metavolcanic rock. Materials from excavation may, in part, be suitable for utilization as backfill, road and yard surfacing, concrete aggregate, and riprap. Some sorting, stockpiling and processing of excavated materials will be required to make them suitable for various intended uses. Excess, as well as materials that are unsuitable for reuse in construction, will be placed in the disposal areas.

Potential disposal areas include: 1) east of visitor parking area adjacent to spillway on YCWA land (~4 ac with a capacity of ~80,000 cu yds); 2) old quarry on NFS land and private land (~8 ac and 100,000 cu yds); 3) flat area on north side of Marysville Road west of quarry on NFS land (~15 ac and 100,000 cu yds); 4) flat area on south side of Marysville Road south of quarry on private land (~20 ac and 100,000 cu yds); and 5) southeast of dam along dirt forest road on YCWA land (~16 ac and 100,000 cu yds).

Construction Traffic Considerations

The construction labor force is estimated to average about 30 to 40 persons over an assumed 3-year construction period. Peak manpower could be close to double this number depending on the contractor's schedule. Personnel and equipment would reach the site via Highway 20 or 49 and Marysville Road, which are paved and suitable for the anticipated loads.

Construction Schedule

A possible construction sequence, involving an approximately 6-year construction period is summarized below. The primary long-lead item is the fabricated steel roller gates together with the hydraulic cylinder operators and hydraulic power units. Schedule highlights are as follows:

At this time, it is anticipated that environmental compliance/permitting will take a total of 3 years, and the design will take 2 years. YCWA anticipates compliance/permitting and design will be completed in parallel, so the total time for these two activities totals 3 years.

Mobilization would include the setup of construction offices, an aggregate crushing plant and a concrete batch plant; the development of disposal and laydown areas; and the construction of the access road to the outlet. It is anticipated that these activities may take about 3 months.

The schedule assumes that YCWA would bid the roller gate package separately from the construction package to expedite the gate procurement. However, the construction contractor could be assigned the procurement contract upon award of the construction contract. The gate procurement cycle, from prime contract award to gate delivery at the site is expected to take 14 months.

Tunnel excavation would begin after completion of the access road, working from the downstream portal towards the inlet. Rock from tunnel excavation would be hauled to the disposal area, or to a stockpile in a laydown area for later use as concrete aggregate. It is expected that tunnel excavation may take about 4 months.

Intake structure excavation would be conducted concurrently with construction of the access road and tunnel excavation. The intake excavation is expected to take about 2 to 3 months.

After tunnel excavation, the reinforced-concrete tunnel lining would be constructed working from the inlet area towards the downstream portal. Once the upstream portion of the tunnel is lined, construction of the intake structure could begin, and could be constructed concurrently with the rest of the tunnel lining. It is anticipated that the tunnel lining and construction of the transition/intake structure would take about 4 to 5 months and 5 to 6 months, respectively.

The reinforced-concrete outlet channel and flip bucket structure would be constructed after the tunnel lining is completed. This activity may take about 3 to 4 months.

The roller gates would be installed after completion of the intake structure construction. Gate installation may take about 2 to 3 months to complete.

Excavation of the approach channel would be performed once the intake structure is in an advanced stage of completion and the reservoir level is sufficiently low. After the approach channel is excavated, the reinforced concrete training walls and slope protection would be constructed. These activities would take about 4 months to complete.

The above summary schedule assumes that the financing plan for the project is in place before award of the construction contract. Also, seasonal schedule constraints that may be imposed by environmental mitigation requirements are not reflected in the summary above.

Figure 4.2-5 is a conceptual-level map of the construction area, as anticipated at this time.

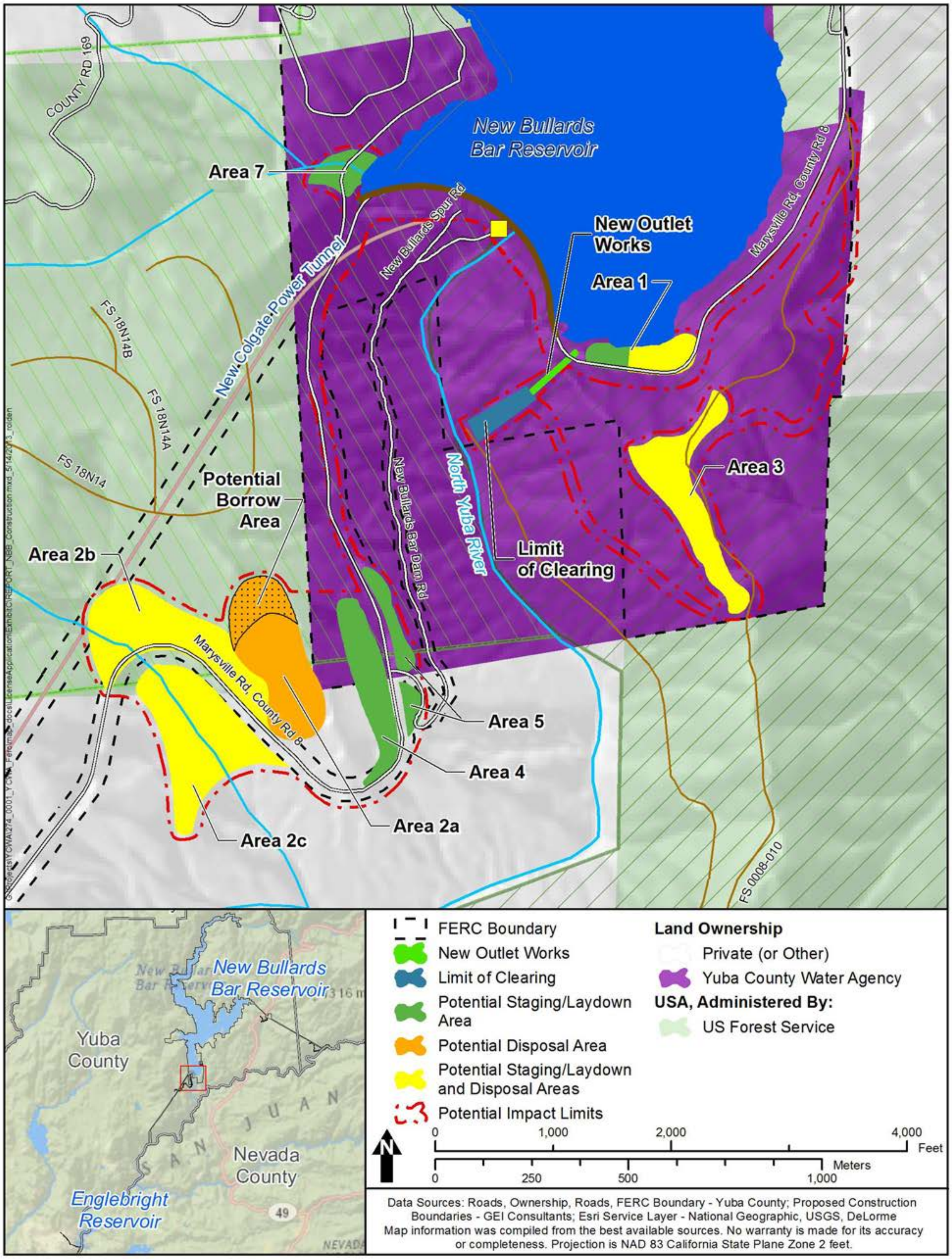

Figure 4.2-5. Construction area for YCWA's proposed New Bullards Bar flood control outlet.

4.2.1.2.2 Recreation Facilities

YCWA proposes several enhancements to the existing Project recreation facilities. When constructing Project recreation facilities, YCWA will obtain all necessary permits and approval for survey work, facility design and on-site resource evaluations, including the Forest Service on NFS land.

A description of these enhancements is provided below.

Schoolhouse Campground

- Replace the lone existing vault restroom (2-unit) with an efficient flush model (including appropriate septic system), if the addition of the flush facility does not exceed the existing water system capacity.
- Convert the double and triple campsites to single campsites.
- Upgrade the host site with water and electric hookups and a septic tank.
- Provide electricity at the entrance kiosk/information board, host site, RV campsites and each restroom.
- Develop up to 12 RV campsites with water and electric hookups. The final number of RV campsites may change during site design due to terrain and road turning radius limitations.
- Restrict RV size at the campground to a 30 ft length, except where RVs up to 40 ft length may be accommodated without 1) significantly re-designing the existing campground circulation road; and 2) reducing the total number of existing campsites.
- Provide appropriate trailhead signage on the facility entrance sign.

Dark Day Campground

- Replace the existing vault restrooms with efficient flush models and sizes that meet Forest Service capacities (including appropriate septic system), if the addition of these flush facilities do not exceed the existing water system capacity
- Convert the double and triple campsites to single campsites
- Expand the capacity by two single campsites, as feasible

Hornswoggle Group Campground

- Replace the existing 4-unit flush restrooms at the Manzanita and Madrone campsites with efficient 2-unit flush models
- Replace the existing, 2-unit vault restrooms at the Sugarpine and Douglas Fir campsites with efficient 1-unit models (including appropriate septic system), if the addition of these flush facilities do not exceed the existing water system capacity

- Install an efficient 1-unit flush restroom at Dogwood and Ponderosa campsites (where restrooms do not currently exist), if the addition of these flush facilities do not exceed the existing water system capacity
- Restrict RV size at the campground to a 30 ft length, except where RVs up to 40 ft length may be accommodated without significantly re-designing the existing campground circulation roads
- Expand the capacity by one group campsite (25-50 PAOT), including a parking area, restroom, and group camping area
- Provide electricity at the entrance kiosk/information board and each restroom

Cottage Creek Campground

- Re-develop the site as a group campground to meet small group camping needs with the following facilities and specifications.
    - ➢ Provide a total of four small group campsites consisting of two 12-PAOT sites and two 18-PAOT sites.
    - ➢ Provide a group living area with a group fire ring, picnic tables and food lockers at each campsite
    - ➢ Provide a paved parking area with spaces designed for a vehicle with a boat trailer for each campsite
    - ➢ Provide an appropriate number (and size) of efficient flush restrooms that meets the standards at the time of design, including lighting (interior and exterior) at the restrooms
    - ➢ Provide a potable water delivery and distribution system

Garden Point Boat-in Campground

- Expand the site capacity by at least five single campsites
- Install additional restrooms that meets the needs of the final number of new campsites developed

Frenchy Point Boat-in Campground

- Decommission the facility due to low use

Dark Day Picnic Area

- Replace the existing vault restroom with an efficient flush model (including appropriate septic system), if the addition of the flush facility does not exceed the existing water system capacity
- Expand the parking area to provide a total of 25 single spaces

- Improve shoreline access, including developing trails and signage
- Recommend a county ordinance establishing a non-motorized boating only zone in the cove to west of the picnic area peninsula
- Remove the Klamath stoves

Sunset Vista Point

- Replace the vault restroom with an efficient flush model (including appropriate septic system), if the addition of the flush facility does not exceed the existing water system capacity
- Install two additional picnic sites, each with a picnic table and a concrete grill with self-contained ash box
- Upgrade the existing picnic site by replacing the picnic table and installing a concrete grill with self-contained ash box
- Enhance the vistas of the reservoir from each picnic site by clearing vegetation per the guidelines in YCWA's Visual Management Plan
- Delineate each parking space, but maintain the existing gravel parking surface; except at the accessible parking spaces (number to be determined during site design), which will be a paved or concrete surface
- Delineate the parking spaces/areas for the vista/picnic visitors and trailhead users
- Improve signage on the entrance sign and all information boards to include all recreational uses at the facility
- Provide a 3-panel interpretive display that includes, at a minimum, information on the Project history and purpose as well as other relevant local/area history

Dam Overlook

- Install an information board identifying the Project recreational facilities and opportunities, including a map

Moran Road Day Use Area

- Develop a turnaround along the car top boat ramp below the high water line designed for vehicles only

Dark Day Boat Launch

- Replace the existing vault restroom with an efficient flush model (including appropriate septic system), if the addition of the flush facility does not exceed the existing water system capacity
- Repair the erosion uphill of the concrete boat ramp

Recreational Trails (Bullards Bar and Schoolhouse Trails)

- Install consistent signage at all Project trailheads, including a: 1) trailhead symbol or identification sign at all facility entrance signs where trailheads are located; 2) trailhead identification sign at all trailhead parking areas; and trailhead information board with trail map and information
- Install consistent directional signage at all Project trail junctions

Decommissioned Burnt Bridge Campground

- Remove the decommissioned facility from the Project Boundary since the facility has already been decommissioned as part of the existing license per an August 19, 1993 FERC Order.[22]

4.2.1.2.3 Implementation Schedule for Recreation Enhancements and Major Rehabilitation

YCWA's proposed Recreation Facilities Plan (Condition RR1) includes a detailed implementation schedule for major rehabilitation, near-term rehabilitation and enhancements at each existing recreation facility. It is important to understand how YCWA developed this schedule. YCWA used the replacement of the existing main line of the recreational facility water delivery system, which is almost entirely underground, as the primary driver of the major rehabilitation schedule of the recreation facilities. The rationale for this approach is primarily the efficiency of the work and to avoid doubling rehabilitation efforts and the resultant significant cost savings. Further, replacement of the underground water system is the single most impactful work project at each facility because the work would affect the most significant (and costly to replace) facilities and amenities within the recreation facilities – the circulation roads, restroom buildings and the septic and leach field systems. As such, YCWA's schedule was developed to complete the main water line replacement and then begin the process of rehabilitating the recreation facilities either concurrently or sequentially following water system replacement while still providing a phased approach to avoid the closure of multiple facilities at the same time. This avoids repeating costly facility major rehabilitation work such as re-paving recently paved roads; moving or altering recently replaced restrooms; and/or re-aligning, extending or relocating recently replaced septic systems and leach fields that might occur if the

[22] Removal of this site from the Project Boundary will occur as part of YCWA's proposed redefining of the boundary around the Project reservoir and impoundments from surveyed coordinates to a contour located above the NMWSE (as detailed in the Section 3.2.2).

underground water system work was completed after major rehabilitation of the recreation facilities.

YCWA recognizes that this approach may not precisely align with the priority of rehabilitation work, particularly for some of the older amenities (e.g., restrooms) based on the current condition of all the facilities and that it may require enhanced minor maintenance of these facilities until the major rehabilitation of the facilities can occur. However, overall, YCWA's believes this approach is ultimately the most efficient and practical approach to provide enhanced recreation facilities over the term of the license with the least disruption to the public overall (minimizes the impact and occurrence of closed facilities) and at significant cost savings to YCWA, primarily by avoiding repeated major rehabilitation efforts at the same facilities.

4.2.2 Proposed Project Boundary

YCWA proposes several changes to the Project Boundary in order to more accurately define lands necessary for the safe operations and maintenance (O&M) of the Project and other purposes, such as recreation, shoreline control, and protection of environmental resources. There are two categories of proposed project boundary changes:

- Proposed addition of lands to the Project Boundary that are currently utilized with a preponderance of use related to the Project O&M, and proposed removal of lands from the Project Boundary that do not have Project facilities and are not used or necessary for Project O&M. These proposed changes are essentially making corrections to the Project Boundary.

- Proposed changes to the FERC Project Boundary around the Project reservoir and impoundments from surveyed coordinates to a contour located above the NMWSE. These changes are proposed, consistent with the preferred method of defining new project boundaries as outlined in the FERC Drawing Guide, as it is a better representation of lands required for Project O&M around the Project reservoirs.

Proposed changes are discussed by Project development below. All proposed changes are described in detail in section 2.0 of Exhibit G.

For the New Colgate Development, YCWA proposes the following changes under the category of corrections to the existing Project Boundary.

- The addition of the areas that encompass 100-ft rights-of-way (i.e., 50 ft on either side of centerline) of six separate Primary Project Roads used to access and maintain the New Colgate Surge Chamber, New Colgate Powerhouse Penstock and New Colgate Powerhouse. Land in these proposed additions is owned by private land owners and by YCWA.

- The removal of the land owned by Pacific Gas and Electric Company (PG&E) to the east of New Colgate Powerhouse (Yuba County APN 048270011000). These lands are not used or needed for Project O&M and are owned and utilized by PG&E for maintenance of PG&E facilities located within the boundaries of that parcel.

- The addition of the area that encompasses USGS gage 11413517 (located at the Old Colgate Diversion Dam) and the Primary Project Trail used to access the gage for Project O&M purposes. Land in this proposed addition is owned by YCWA.

- The removal of the area that encompasses a section of Marysville Road (County Road 8) that is in the existing Project Boundary. Marysville Road is commonly used for many purposes not related to the Project and as such it is not considered a Primary Project Road. Land in this proposed removal is owned by private land owners and by YCWA.

- The addition of the area that encompasses a 20-ft right-of-way (i.e., 10 ft on either side of centerline) around the Primary Project Trail that is used to access USGS gage #11413517 downstream of the New Bullards Bar Minimum Flow Powerhouse. Land in this proposed addition is owned by YCWA.

- The removal of the area north of an 50-ft offset from centerline of County Road 169 from Cottage Creek Campground to the reservoir's edge. Land parcels in this region are not currently used for Project O&M. Land in this proposed removal is owned by YCWA and is NFS land managed as part of the PNF.

- The removal of the area that encompasses the Administration Site to the north of Sunset Vista Point that is used for non-Project related activities by the Forest Service with the exception of the water supply system to Project recreation sites including a 25-ft offset from water distribution tanks and 20-ft right-of-way (10-ft on either side of water distribution pipe alignments). Land in this area is NFS land managed as part of the TNF.

- The addition of the area that encompasses a 20-ft right-of-way (i.e., 10 ft on either side of centerline) around the Project portion of the New Bullards Bar Trail that follows along the southeast side of the New Bullards Bar Reservoir. Lands in this proposed addition are NFS land managed as part of the TNF, and private land owned by YCWA.

- The addition of the area that encompasses a 20-ft right-of-way (i.e., 10 ft on either side of centerline) around the Schoolhouse Trail that provides access to the Bullards Bar Trail from Schoolhouse Campground. Lands in this proposed addition are federal lands managed by the Forest Service as part of the TNF, Yuba County road right-of-way, and private lands.

- The addition of the area that encompasses a 20-ft right-of-way (i.e., 10 ft on either side of centerline) around the water distribution pipe alignments that parallel both Marysville Rd (County Rd 8) and Dark Day Rd. The water distribution system provides water to Project Recreation Sites and is considered a Project Facility. Lands in this proposed addition are NFS land managed as part of the TNF.

- The addition of the area that encompasses the leach field that is a part of the Hornswoggle Group Campground. Land in this proposed addition is NFS land managed as part of the TNF.

- The addition of the area that encompasses a 100-ft right-of-way (i.e., 50 ft on either side of centerline) around the Primary Project Road that is used to access USGS gage #11408880 located downstream from Our House Diversion Dam. Land in this proposed addition is NFS land managed as part of the TNF.

For the New Colgate Development, YCWA proposes the following changes under the category of redefining the boundary around the Project reservoir and impoundments from surveyed coordinates to a contour located above the NMWSE. A contour 30 ft above NMWSE or 200 horizontal ft from the NMWSE was chosen to define the proposed boundary for each of the three Project impoundments in areas where the boundary is not already defined to encompass Project facilities and recreation sites. The proposed boundary will encompass between 50 and 200 horizontal ft from reservoir NMSWE except where slopes exceed 60 percent, in which case the boundary would encompass less than 50 horizontal ft. As such the proposed boundary will provide shoreline access of at least 50 ft for all areas except for where slopes are unsafe.

- The addition and removal of land such that Project Boundary around New Bullards Bar Reservoir (where the Project Boundary is not encompassing Project facilities) is defined by the lesser (closer to reservoir NMWSE) of either the topographic contour of 1,985 ft, which is 30 ft above the NMWSE, or 200 horizontal ft from the NMWSE. Land parcels in this proposed change are owned by private land owners and YCWA and federal lands managed by the Forest Service as part of the PNF and TNF.

- The addition and removal of lands such that Project Boundary around Log Cabin Diversion Dam impoundment (where the Project boundary is not encompassing Project facilities) is defined by the topographic contour of 2,000 ft, which is 30 ft above the NMWSE. Land parcels in this proposed change are federal lands managed by the Forest Service as part of the TNF, by YCWA, and a small area within a Yuba County road right-of-way.

- The addition and removal of lands such that Project Boundary around Our House Diversion Dam impoundment (where the Project Boundary is not encompassing Project facilities) is defined by the topographic contour of 2,060 ft, which is 30 ft above the NMWSE. Land parcels in this proposed change are federal land managed by the Forest Service as part of the TNF and land owned by private land owners.

For the Narrows 2 Development, YCWA proposes the following changes under the category of corrections to the existing Project Boundary.

- The addition of the area that encompasses a 20-ft right-of-way (i.e., 10 ft on either side of centerline) around the Primary Project trail that is used to access USGS gage #11418000 located downstream of the Narrows 2 Powerhouse. Land parcels in this proposed addition are owned by private land owners.

- The removal of the area that extends south beyond a 100-ft right-of-way (i.e., 50 ft on either side of centerline) along the Narrows 2 Access Road, which is a Project road. These lands are not used for Project O&M and do not have any Project or non-Project facilities. Land parcels in this proposed removal are federal land managed by the Corps, land owned and managed by the State of California, and land owned by private land owners.

- The removal of the area that contains Englebright Dam including a 50-foot offset from the dam structure. These land parcels are not used for Project O&M and do not have any Project or non-Project facilities except for the Narrows 2 Power Tunnel that passes underneath Englebright Dam. As such, the purpose is to remove the portion of the non-Project Englebright Dam from the Project Boundary. Land parcels in the proposed removal are federal land managed by the Corps.

Table 4.2-1. Summary of land ownership within the proposed Yuba River Development Project FERC Project Boundary by Project Development and difference as compared to existing FERC Project Boundary.

Development	Forest Service (ac)	USACE (ac)	State of California (ac)	YCWA (ac)	Other Private (ac)	Total	
						Acres	Percent
PROPOSED PROJECT BOUNDARY							
New Colgate	3,291.2	0	0	2,578.5	195.6	6,065.3	99.5%
New Bullards Minimum Flow	0	0	0	<0.1	0	<0.1	0%
Narrows 2	0	11.1	19.5	1.2	0.8	32.6	0.5%
Total	**3,291.2**	**11.1**	**19.5**	**2,579.7**	**196.4**	**6,097.9**	**100%**
Percent	**54.0%**	**0.2%**	**0.3%**	**42.3%**	**3.2%**	**--**	**--**
DIFFERENCE BETWEEN EXISTING (TABLE 5.0-1) AND PROPOSED PROJECT BOUNDARY							
Difference	**-1,125.5**	**-5.0**	**-0.6**	**-569.6**	**-16.6**	**-1,717.3**	**-21.7%**

4.2.3 Proposed Project Operations

YCWA proposes to continue to operate the Project as it has operated historically (i.e., since 2006 when the Yuba Accord went into effect), with the new facilities and YCWA's proposed conditions, which are listed below.

4.2.4 Proposed Environmental Conditions

Table 4.2-2 lists YCWA's proposed conditions measures by major resource area, and are included in their entirety in Attachment A to this Applicant-Prepared Draft EFH.

Table 4.2-2. Measures included in YCWA's Proposed Yuba River Development Project.

YCWA's Proposed Measure	Description
GENERAL	
GEN1	Consult with the Forest Service Annually Regarding Project Effects on NFS Land
GEN2	Consult with the Forest Service Regarding New Ground Disturbing Activities on NFS Land
GEN3	Consult with the Forest Service Regarding New Facilities on NFS Land
GEN4	Consult with Forest Service Regarding Pesticide Use on NFS Land
GEN5	Review Special-status Species Lists and Assess Newly-listed Species Annually
GEN6	Provide Environmental Training to Employees
GEN7	Develop and Implement a Coordinated Operations Plan for Yuba River Development Project and Narrows Project
GEN8	Right to Use Englebright Dam and Reservoir
GEOLOGY AND SOILS	
GS1	Implement Erosion and Sediment Control Plan[1]
GS2	Implement Our House and Log Cabin Diversion Dams Sediment Removal Plan[1]
GS3	Pass Sediment at Our House and Log Cabin Diversion Dams
GS4	Monitor Channel Morphology Downstream of Our House and Log Cabin Diversion Dams
GS5	Pass Large Woody Material at Our House and Log Cabin Diversion Dams
GS6	Implement New Bullards Bar Reservoir Floating Material Management Plan[1]
WATER RESOURCES	
WR1	Implement Hazardous Substances Plan[1]
WR2	Determine Water Year Types for Measures Pertaining to Our House Diversion Dam, Log Cabin Diversion Dam and New Bullards Bar Dam
WR3	Determine Water Year Types for Measures Pertaining to Narrows 2 Powerhouse and Narrows 2 Full Bypass
WR4	Implement Streamflow and Reservoir Level Monitoring Plan[1]
WR5	Maintain New Bullards Bar Reservoir Minimum Pool
WR6	Operate New Bullards Bar Reservoir for Flood Control
AQUATIC RESOURCES	
AR1	Maintain Minimum Streamflows below Our House Diversion Dam, Log Cabin Diversion Dam and New Bullards Bar Dam
AR2	Control Project Spills at Our House Diversion Dam
AR3	Maintain Minimum Streamflows at Narrows 2 Powerhouse and Narrows 2 Full Bypass
AR4	Control Project Spills at New Bullards Bar Dam
AR5	Implement Aquatic Invasive Species Management Plan[1]
AR6	Implement New Bullards Bar Reservoir Fish Stocking Plan[1]
TERRESTRIAL RESOURCES	
TR1	Implement Integrated Vegetation Management Plan[1]
TR2	Implement Bald Eagle and American Peregrine Falcon Management Plan[1]
TR3	Implement Ringtail Management Plan[1]
TR4	Manage Bats at Project Facilities
ESA-LISTED SPECIES	
TE1	Monitor Water Temperature Downstream of Narrows 2 Powerhouse
TE2	Monitor Chinook Salmon Downstream of Narrows 2 Powerhouse
TE3	Establish Lower Yuba River Anadromous Fish Ecological Group
TE4	Control Project Ramping and Flow Fluctuations Downstream of Englebright Dam
RECREATION RESOURCES	
RR1	Implement Recreation Facilities Management Plan[1]
RR2	Provide Recreation Flow Information
LAND USE	
LU1	Implement Transportation System Management Plan[1]
LU2	Implement Fire Prevention and Response Plan[1]
CULTURAL RESOURCES	
CR1	Implement Historic Properties Management Plan[2]
AESTHETIC RESOURCES	
VR1	Implement Visual Resource Management Plan[1]

1 Plan included in Appendix E3 of Exhibit E of Application for New License.
2 Plan included in Volume IV of Application for New License, and is considered Privileged.

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SECTION 5.0

DESCRIPTION OF THE EFH ACTION AREA

5.1 NMFS Designation of EFH

The geographic extent of a Chinook salmon EFH Action Area includes the portion of a watershed within specific hydrologic units (HU) that are currently, or were historically, accessible to the anadromous fish species.

Designated EFH for Chinook salmon is identified in Amendment 14 of the Pacific Coast Salmon FMP and codified in 50 C.F.R. section 660.412(a) and part 660, subpart H, table 1. This designation does not identify any specific Chinook salmon races (e.g., spring-run or fall-run). Central Valley spring-run and fall/late fall-run Chinook salmon are the only runs of Chinook salmon that occur in the Yuba River. To identify watersheds that contain EFH, NMFS uses fourth field hydrologic unit codes (HUCs) developed by the USGS (defined in the Department of the Interior, USGS publication; Hydrologic Unit Maps, Water Supply Paper 2294, 1987).

NMFS' *2008 Final Rule to Implement EFH for Pacific Salmon Included in Amendment 14 to the Pacific Salmon FMP* (73 FR 60987) included two 4th field hydrologic units that were identified (Table 5.1-1) (see 50 C.F.R., pt. 660., subpt. H, table 1).

Table 5.1-1. Pacific Salmon EFH Identified by USGS Hydrologic Unit Code (HUC) for the Lower Yuba River (73 FR 60987).

USGS HUC	Hydrologic Unit Name	Salmon Species	Impassible Man–made Barrier (if present)
18020107	Lower Yuba River	Chinook salmon	n/a
18020125	Upper Yuba	Chinook salmon	n/a

Neither the 2008 Final Rule nor the more recent 2011 5-Year Review of EFH identified Englebright Dam or any upstream dams as impassible man-made barriers limiting the geographical extent of Chinook salmon EFH in the Yuba River watershed.

As discussed in NMFS and PFMC (2011a), numerous dams block access to historical salmon habitat or alter the hydrography of downstream river reaches. In identifying EFH in Amendment 14, the PFMC considered dams that completely blocked fish passage, and used four criteria to determine whether a particular dam should represent the upstream extent of EFH:

- *Is the dam federally owned or operated, licensed by the Federal Energy Regulatory Commission (FERC), state licensed, or subject to state dam safety supervision?* This criterion assures the dam is of sufficient size, permanence, impassibility, and legal identity to warrant consideration for inclusion in this list.
- *Is the dam upstream of any other impassible dam?* This criterion provides for a continuous boundary of designated habitat.

- *Is fish passage to upstream areas under consideration, or are fish passage facilities in the design or construction phase?* The discussion about this criterion states that there is no currently, or soon to be, accessible freshwater salmon habitat that is expendable. All such habitat is key to the conservation of these species and needs the special considerations for protection and restoration incumbent with designation.
- *Has NMFS determined that the dam does not block access to habitat that is key for the conservation of the species?* This criterion provides for designation of habitat upstream of, and exclusion of, otherwise listed dams when NMFS is able to determine restoration of passage and conservation of such habitat is necessary for long-term survival of the species and sustainability of the fishery.

As a result, EFH was designated above a number of impassible dams that met one or more of these criteria, including Englebright Dam in the Yuba River Basin. Justification for designating EFH above impassable barriers has been provided in both the EFH regulations and Amendment 14 to the FMP. 50 C.F.R. section 600.815(a)(1)(iv)(F) states:

> If degraded or inaccessible aquatic habitat has contributed to reduced yields of a species or assemblage and if, in the judgment of the Secretary and the appropriate Council(s), the degraded conditions can be reversed through such actions as improved fish passage techniques (for stream or river blockages), improved water quality measures (removal of contaminants or increasing flows), and similar measures that are technologically and economically feasible, EFH should include those habitats that would be necessary to the species to obtain increased yields.

Amendment 14 included the following language regarding habitat needed to support a sustainable fishery and the identification of such habitat through other processes and analyses:

> While available information is not sufficient to conclude that currently accessible habitat is sufficient for supporting sustainable salmon fisheries and a healthy ecosystem, subsequent analyses (e.g., in recovery planning, ESA consultations, or hydropower proceedings) may conclude that inaccessible habitat should be made available to the species.

NMFS and PFMC (2011a) also stated that the EFH provisions of the MSFCMA are intended to ensure conservation and protection of EFH to promote a sustainable fishery, which requires a more robust population than necessary to ensure persistence of the population or ESU. Therefore, the PFMC determined that if the habitat may be necessary for the persistence of the population or ESU, it is clearly necessary to promote a sustainable fishery. As demonstrated in both the EFH regulations and Amendment 14 to the FMP, designating EFH above impassable dams is appropriate under certain conditions and has been done in the past (NMFS and PFMC 2011a).

In response to comments by PFMC members, Advisory Committees, Management Bodies, and the public, several revisions were made to the March 23, 2011 Final Report on the 5-year review of EFH for Pacific Coast salmon. According to the revised May 25, 2011 report (NMFS and PFMC 2011a), updated GIS data has become available that more accurately defines the spatial extent, names, and codes of the HU sub-basin boundaries, particularly in the California Central Valley. Consequently, some of the 4th field HUs listed in Amendment 14 that should be removed from EFH for Chinook salmon because they no longer exist. The Lower Yuba River HU No. 18020107 is one of the 4th field HUs in California that are currently designated as EFH for Chinook salmon in Amendment 14, but due to revisions in the HU codes and names, no longer exists. The revised HU delineation for EFH in the Yuba River watershed is presented in Figure 5.1-1.

Although not identified in the NMFS EFH regulations as an impassible man-made barrier, Englebright Dam blocks access by anadromous salmonids to the historically utilized habitat located upstream above the dam. The construction and the continued existence of Englebright Dam have resulted in effects that have contributed to the current status of the managed species within the EFH Action Area, and these effects are considered to be part of the Environmental Baseline (see Chapter 6 of the BA). Consequently, Chinook salmon in the lower Yuba River are restricted to the approximate 24 miles extending from Englebright Dam to the mouth of the lower Yuba River. NMFS has not established EFH for steelhead in the Yuba River because EFH only applies to commercial fisheries, which do not include steelhead.

Figure 5.1-1. Comparison of the California Central Valley 4th field HUs designated as EFH in Amendment 14 with the newly defined HUs having current or historical Chinook salmon distribution data (Modified from NMFS and PFMC 2011a; NMFS 2011).

5.2 FERC's Defined Action Area

The Action Area for this Applicant-Prepared Draft EFH assessment is determined considering the extent of the direct and indirect effects of the Proposed Action, including consideration of the existing FERC Project Boundary. This section also describes upstream adjacent areas in the upper Yuba River watershed, including the North, Middle, and South Yuba watersheds, which are located within EFH for Pacific Coast salmon, and which were suggested by NMFS during the FERC relicensing scoping process (see Section 1.0). Upstream adjacent areas are those areas that are affected by the Proposed Action, but that are not occupied by any of the managed species addressed in this EFH assessment.

5.2.1 Adjacent Areas in the Yuba River Watershed Upstream of Englebright Dam and Reservoir

5.2.1.1 North Yuba River

For the North Yuba River, NMFS (2011b) has designated Chinook salmon EFH "*To Salmon Creek, near Sierra City*." There are no known natural obstructions from Downieville upstream to Sierra City, where Salmon Creek enters the North Yuba River (Yoshiyama et al. 2001). Relatively deep pools are present throughout the North Yuba River from its mouth up to Sierra City (E.R. Gerstung, personal observation in Yoshiyama et al. 2001), and could have provided holding habitat for spring-run Chinook salmon (Yoshiyama et al. 2001).

For this EFH assessment, potential Project-related effects having the potential to affect EFH in the North Yuba River are limited to the following geographic areas.

5.2.1.1.1 New Bullards Bar Reservoir

Approximately 15.4 miles of the North Yuba River canyon from the normal maximum water surface elevation of the reservoir at RM 17.8 to New Bullards Bar Dam at RM 2.4.

5.2.1.1.2 New Bullards Bar Dam Reach

Approximately 2.4 miles of the North Yuba River from the New Bullards Bar Minimum Flow Release Powerhouse at RM 2.4 to the confluence of the North Yuba River with the Middle Yuba River at RM 0.

5.2.1.2 Middle Yuba River

In the Middle Yuba River, NMFS EFH includes; *"The lower river, near where the North Fork joins"*. This assessment is presumably based on Yoshiyama et al. (2001) who considered a 10-foot-high falls on the lower Middle Yuba River located about 1.5 miles above the mouth as the effective upstream limit of salmon movement, and who cited 1938 unpublished Cal Fish and Wildlife data supposedly documenting both salmon and steelhead in this lower part of the

Middle Yuba River. Because the North Yuba River joins the Middle Yuba River at the Middle Yuba River's most downstream end, there is little designated EFH in the Middle Yuba River.

For this EFH assessment, potential Project-related effects having the potential to affect EFH downstream in the Middle Yuba River are limited to the following geographic areas.

5.2.1.2.1 Our House Diversion Dam Impoundment

Approximately 0.1-mile of the Middle Yuba River canyon from the normal maximum water surface elevation of the impoundment at RM 13.0 to the dam at RM 12.6.

5.2.1.2.2 Our House Diversion Dam Reach

Approximately 7.9 miles of the Middle Yuba River from Our House Diversion Dam at RM 12.6 to the confluence of the Middle Yuba River and Oregon Creek at RM 4.7.

5.2.1.2.3 Oregon Creek Reach

Approximately 4.7 miles of the Middle Yuba River from the confluence of the Middle Yuba River and Oregon Creek at RM 4.7 to the confluence of the Middle Yuba River with the North Yuba River at RM 0.0.

5.2.1.2.4 Log Cabin Diversion Dam Impoundment

Approximately 0.2 mile of Oregon Creek canyon from the normal maximum water surface elevation of the impoundment at RM 4.5 to the dam at RM 4.3.

5.2.1.2.5 Log Cabin Diversion Dam Reach

Approximately 4.3 miles of Oregon Creek from RM 4.3 to the confluence of Oregon Creek with the Middle Yuba River.

5.2.1.3 South Yuba River

In the South Yuba River, NMFS' EFH includes "*1-2 miles upstream, perhaps spring run accessed to the present town of Washington.*" The South Yuba River extends approximately 29 miles from the upper end of Englebright Reservoir to the Town of Washington (PG&E and NID 2010). There are records of salmon occurring within 1 to 2 miles upstream of the mouth of the South Yuba River (CDFG unpublished data as cited in Yoshiyama et al. 2001). Yoshiyama et al. (2001) consider the cascade, with at least a 12-foot drop, located 0.5 mile below the juncture of Humbug Creek as essentially the historical upstream limit of salmon during most years of natural streamflows.

Because the Project would not involve any activities in the South Yuba River, it does not have the potential to affect EFH in the South Yuba River. Therefore, the South Yuba River is not considered further in this EFH assessment.

5.2.1.4 Yuba River Upstream of Englebright Reservoir

5.2.1.4.1 Middle/North Yuba River Reach

Approximately 5.8 miles of the Yuba River from the confluence of the North Yuba River and the Middle Yuba River at RM 39.7 to the New Colgate Powerhouse at RM 33.9.

5.2.1.4.2 New Colgate Powerhouse Reach

Approximately 1.7 miles of the Yuba River from New Colgate Powerhouse at RM 33.9 to the normal maximum water surface elevation of the Corps' Englebright Reservoir at RM 32.2.

5.2.1.4.3 Corps' Englebright Reservoir

Approximately 8.2 miles of the Yuba River from the normal maximum water surface elevation of the Corps' Englebright Reservoir at RM 32.2 to the Corps' Englebright Dam at RM 24.0.

No Chinook salmon are present in the Yuba River Basin upstream of Englebright Dam, nor have they been present upstream of Englebright Dam since its construction in 1941.

5.2.2 Lower Yuba River Downstream of Englebright Dam and Reservoir

Presently, Chinook salmon in the Yuba River watershed are restricted to the lower 24 miles of the Yuba River. The EFH Action Area includes the lower Yuba River starting at Englebright Dam, downstream to the confluence with the Feather River.

5.2.2.1 Reaches

Various reach delineations of the Yuba River have been used for specific studies and purposes in the lower Yuba River. For the purposes of evaluation of the potential effects to listed species addressed in this BA, two sets of reach delineations are primarily referred to: (1) geomorphic reaches; and (2) hydrologic reaches/zones.

The geomorphic reaches were delineated by Wyrick and Pasternack (2012) into eight segments based on the longitudinal profile and associated geomorphic variables. Tributary junctions form the upstream boundary of two reaches and dams form the boundary for two more reaches. The other reach boundaries are formed by hydro-geomorphic variables such as the onset of emergent floodplain gravel, transition from confined bedrock valley to wider, meandering system, and decreases in bed channel slope. Table 5.2.2-1 provides length and gradient of each of the reaches. Figure 5.2.2-1 provides a map of the geomorphic reaches in relation to local landmarks.

These geomorphic reaches were utilized by the RMT (2013) in describing geomorphological characteristics of the lower Yuba River.

Table 5.2.2-1. Geomorphic reaches in the Yuba River downstream from Englebright Dam.

Reach Name	Description	Gradient (%)[1]	Start (RM)[1]	End (RM)[1]	Length (mile)
Englebright Dam	Englebright Dam to confluence with Deer Creek	0.31	23.4	24.2	0.8
Narrows	Deer Creek to emergent gravel at canyon mouth	Not Measurable[2]	22.3	23.4	1.1
Timbuctoo Bend	Upstream of Hwy 20 Bridge to end of emergent gravel bar by Blue Point Mine	0.20	18.6	22.3	3.8
Parks Bar	Dry Creek to 0.35 mi upstream of Hwy 20 Bridge	0.19	13.9	18.6	4.7
Dry Creek	Daguerre Point Dam to Dry Creek	0.14	11.6	13.9	2.3
Daguerre Point Dam	RM 8.3 to Daguerre Point Dam	0.18	8.3	11.6	3.3
Hallwood	RM 3.3 to slope break near Eddie Drive at RM 8.3	0.13	3.3	8.3	5.0
Marysville	Junction with Feather River to RM 3.3	0.05	0.0	3.3	3.3
	Total	**0.16**	**0.0**	**24.2**	**24.2**

1 Closest RM from base map drafted by YCWA in 2012. RMs were digitized at a large scale over high-resolution aerial imagery along the active river alignment.

2 The Narrows Reach is very confined with Class III-V rapids that prevent topographic and bathymetric surveys due to safety and accessibility issues. Slope and thalweg location cannot be accurately determined (Wyrick and Pasternack 2012).

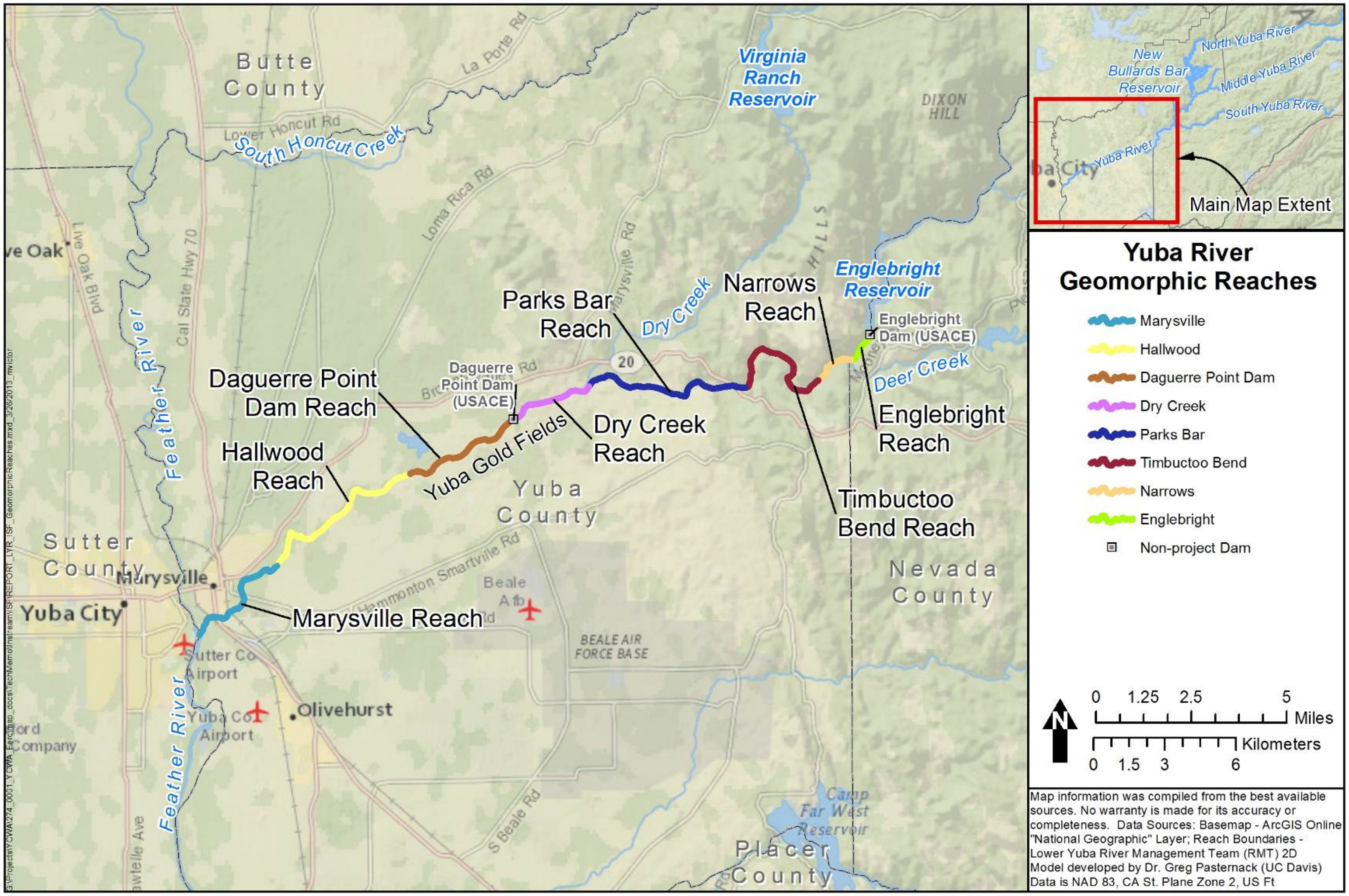

Figure 5.2.2-1. Map of study area showing geomorphic reach boundaries.

5.3 Other Aquatic Habitat Areas of Chinook Salmon EFH in the ESU (Downstream of the Project Area)

The discussion of the status of species managed under the Pacific Coast Salmon Fisheries Management Plan (PFMC 2012) includes information on the species' life history, current known range and habitat use, distribution, and other data regarding factors necessary to the species' survival. Because in recent years managed species (i.e., Chinook salmon) are declining through many areas of their range, the overall population trend of a species has implications for new proposals that could result in additional effects on the species (USFWS and NMFS 1998). The trends of the remaining populations of managed species form the basis for evaluating the effects of a proposed action on that species. USFWS and NMFS (1998) further state that "*Unless a species' range is wholly contained within the action area, this analysis* [describing the status of a species within the action area] *is a subset of the preceding rangewide status discussion*."

The downstream extent of the Action Area is defined to the point where there are measurable effects to river flow and habitat availability associated with the Proposed Action (NMFS 2012). It is not anticipated that direct or indirect effects would occur to managed species or EFH downstream of the mouth of the lower Yuba River (e.g., in the lower Feather River or Sacramento River). Substantial changes in lower Yuba River flows would not occur under the Proposed Action, relative to existing habitat conditions, indicating that changes in aquatic habitat conditions downstream of the mouth of the lower Yuba River would not be measurable. Moreover, because operations of the SWP control flows in the lower Feather River, even if measurable changes to flows in the lower Yuba River were to occur, it would not be practicable to attempt to segregate potential changes in lower Feather River flow downstream of the lower Yuba River associated with potential changes in lower Yuba River outflow. Similarly, NMFS (2012) excluded the Sacramento River downstream from the Feather River from the action area for the Biological Opinion on the Corp's *Continued Operation and Maintenance of Englebright Dam and Reservoir, Daguerre Point Dam, and Recreational Facilities On and Around Englebright Reservoir* in the lower Yuba River, because the flows in the Sacramento River are mixed with natural flows and those related to the operation of the CVP and the SWP, so that the effects of these co-mingled flows and their effects on spring-run Chinook salmon, steelhead and green sturgeon are not easily segregated.

Because the managed fish species (i.e., Chinook salmon) that inhabit the lower Yuba River are anadromous, they do not reside in the lower Yuba River for their entire lifecycles. Aquatic habitat conditions at the ESU scale, including the Feather River, the Sacramento River and the Sacramento-San Joaquin Delta (Delta) have the potential to affect Chinook salmon (Figure 5.3-1). Therefore, to characterize the existing habitat conditions associated with EFH for Chinook salmon, additional consideration is given to the aquatic habitat conditions, and potential limiting factors and threats that may influence Chinook salmon from both local and ESU-wide perspectives.

Figure 5.3-1. Other EFH areas affecting Yuba River spring- and fall-run Chinook salmon throughout the ESUs.

5.3.1 Feather River

The Feather River Basin encompasses an area of about 5,900 square miles (DWR 2007). The Feather River is considered to be a major tributary to the Sacramento River and provides about 25 percent of the flow23 in the Sacramento River (DWR 2007). The lower Feather River extends from the Fish Barrier Dam (RM 67.25) near Oroville Reservoir downstream to the confluence of the Feather and Sacramento rivers (RM 0).

Flows in the lower Feather River are influenced by releases from Oroville Dam and Reservoir, which is operated by DWR as part of the SWP. Downstream of Oroville Dam, water is diverted in several directions to: (1) the Thermalito Complex; (2) the Feather River Fish Hatchery (FRFH); and (3) the Low Flow Channel. The sources combine below the Thermalito Afterbay, creating the High Flow Channel. The Low Flow Channel is highly regulated and contains the majority of the anadromous salmonid spawning habitat. The Yuba and Bear rivers are both tributaries to the Feather River. The Yuba River flows into the Feather River near the City of Marysville, 39 RM downstream of the City of Oroville. The Bear River flows into the Feather River about 55 RM downstream of the City of Oroville. Approximately 67 RM downstream of the City of Oroville, the Feather River flows into the Sacramento River near the town of Verona (DWR 2007).

5.3.2 Sacramento River

The Sacramento River is the largest river system in California, yielding 35 percent of the State's water supply. Most of the Sacramento River flow is controlled by Reclamation's Shasta Dam and Reservoir, and river flow is augmented by transfer of Trinity River water through Clear and Spring Creek tunnels to Keswick Reservoir. Immediately below Keswick Dam, the river is deeply incised in bedrock with very limited riparian vegetation.

The upper Sacramento River is often defined as the portion of the river from Princeton (RM 163; downstream extent of salmonid spawning in the Sacramento River) to Keswick Dam (the upstream extent of anadromous fish migration and spawning). The Sacramento River is an important corridor for anadromous fishes moving between the ocean and Delta and upstream river and tributary spawning and rearing habitats. The upper Sacramento River is differentiated from the river's "headwaters" which lie upstream of Shasta Reservoir. The upper Sacramento River provides a diversity of aquatic habitats, including fast-water riffles and shallow glides, slow-water deep glides and pools, and off-channel backwater habitats (Reclamation and SAFCA 2004).

The lower Sacramento River is generally defined as the portion of the river from Princeton to the Delta at approximately Chipps Island (near Pittsburg). The lower Sacramento River is predominantly channelized, leveed and bordered by agricultural lands. Aquatic habitat in the lower Sacramento River is characterized primarily by slow water glides and pools, is

[23] As measured at Oroville Dam.

depositional in nature, and has lower water clarity and habitat diversity, relative to the upper portion of the river.

5.3.3 Sacramento-San Joaquin Delta

The Delta is a vast, low-lying inland region located east of the San Francisco Bay Area, at the confluence of the Sacramento and San Joaquin rivers. Geographically, this region forms the eastern portion of the San Francisco estuary, which includes San Francisco, San Pablo, and Suisun bays (Figure 5.3-1). An interconnected network of water channels and man-made islands, the Delta stretches nearly 50 miles from Sacramento south to the City of Tracy, and spans almost 25 miles from Antioch east to Stockton (Public Policy Institute of California 2007). The Delta is a complex area for both anadromous fisheries production and distribution of California water resources for numerous beneficial uses. The Delta also includes the Federal CVP Jones Pumping Plant and the SWP Banks Pumping Plant in the south Delta (export pumps). Water withdrawn from the Delta provides for much of California's water needs, including both drinking water and water for agricultural irrigation purposes.

5.3.4 Pacific Ocean

The Pacific Ocean is part of the EFH for Pacific salmon. Important elements of marine EFH include estuarine rearing, ocean rearing, and juvenile and adult migration (PFMC 1999). The spatial distribution of suitable marine habitat conditions is affected by annual and seasonal changes in oceanographic conditions and may affect the tendency for fish to migrate from, or reside in, coastal areas after ocean entry (PFMC 1999). Although potential effects associated with the Project will not affect marine EFH, the Pacific Ocean is identified here for completeness in characterizing Pacific salmon EFH.

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SECTION 6.0

SPECIES MANAGED UNDER THE PACIFIC COAST SALMON FISHERIES MANAGEMENT PLAN

Although EFH pertains to all Pacific Coast salmon, fall-/late fall-run Chinook salmon and their associated habitat requirements are the species discussed in this chapter because: 1) spring-run Chinook salmon and their critical habitat were discussed in Chapter 5 of the Applicant-Prepared Draft BA (Status of the Species) and evaluated in the Draft BA because of their status as a threatened species under the Federal ESA; and 2) species other than fall-/late fall-run Chinook salmon requiring EFH evaluation do not occur in the Action Area (e.g., lower Yuba River). The discussions in Chapter 5 of the Draft BA addressed: 1) listing status and critical habitat designation; 2) a review of available information; 3) life history and habitat requirements; 4) limiting factors and threats (e.g., historical and current pressures, limiting factors for recovery within the ESU and within the Action Area); 5) viability of the Central Valley ESU and Yuba River populations; and 6) recovery plan implementation.

To supplement the information on Chinook salmon presented in Chapter 5 of the Applicant-Prepared Draft BA, general life history information and habitat requirements for fall- and late fall-run Chinook salmon are presented here. Further detailed information on the spring-run and fall-/late fall-run Chinook salmon ESUs are available in NMFS' Technical Memorandum NMFS-NWFSC-35 – Status Review of Chinook Salmon from Washington, Idaho, Oregon, and California (Myers et al. 1998), and NMFS' Technical Memorandum NMFS-NWFSC-66 – Updated Status of Federally Listed ESUs of West Coast Salmon and Steelhead (Good et al. 2005).

6.1 Central Valley Fall-/Late Fall-run Chinook Salmon ESU

Central Valley fall- and late fall-run Chinook salmon are considered by NMFS to be the same ESU (64 FR 50394). NMFS determined that listing this ESU as a threatened species was not warranted (64 FR 50394), but subsequently classified this ESU as a Federal Species of Concern because of specific risk factors, including population size and hatchery influence (69 FR 19975; CDFG 2011a). Central Valley late fall-run Chinook salmon also are listed as a State Species of Special Concern (CDFG 2011). The ESU includes all naturally spawned populations of fall-run Chinook salmon in the Sacramento and San Joaquin river basins and their tributaries east of Carquinez Strait, California.

Chinook salmon are the largest of the Pacific salmon and are highly prized by commercial, sport, and subsistence fishers (NMFS 2009a). Chinook salmon can be found in the ocean along the west coast of North America from south of Monterey, California, to Alaska, but the southern extent of spawning is in the San Joaquin and Kings rivers (Moyle 2002). The fisheries of healthy Pacific coast Chinook salmon stocks are managed by the PFMC under the Pacific Salmon FMP. Approximately 80 percent of the California catch comes from fish from the Central Valley as opposed to fish from the Klamath River system, although as much as 90 percent of the caught fish may be of hatchery origin (Barnett-Johnson et al. 2007). These stocks include fall and late-fall run Chinook salmon from the Klamath and Central Valley systems (Reclamation 2008).

6.1.1 General Life History and Habitat Requirements

This section presents a general overview of lifestage-specific information (e.g., adult immigration and holding, adult spawning, embryo incubation, juvenile rearing and downstream movement) for the ESU. Then, this section specifically focuses and provides information on lifestage specific temporal and spatial distributions for fall-/late fall-run Chinook salmon in the lower Yuba River. The lower Yuba River is utilized by two principal Chinook salmon runs (i.e., spring-run and fall-run Chinook salmon). Although late fall-run Chinook salmon populations occur primarily in the Sacramento River (CDFG Website 2007 in RMT 2010), incidental observations of late fall-run Chinook salmon have been reported to occur in the lower Yuba River (D. Massa, CDFG, pers. comm. 2009; M. Tucker, NMFS, pers. comm. 2009). Although reported, there have been only occasional episodic incidences of late fall-run Chinook salmon straying from the Sacramento River system into the lower Yuba River. For example, six Chinook salmon adults were recovered during the late-winter and early-spring portion of the 2008 escapement surveys with Coded Wire Tags demonstrating that these fish were late fall-run fish from the Coleman National Fish Hatchery located on Battle Creek (YCWA 2009). This Applicant-Prepared Draft EFH assessment addresses the Central Valley fall- and late fall-run Chinook salmon ESU as defined by NMFS, but the assessment focuses on fall-run Chinook salmon lifestages that have the potential to be affected by the Proposed Action.

Recently, the RMT developed representative temporal distributions for specific fall-run Chinook salmon lifestages through review of previously conducted studies, as well as recent and currently ongoing data collection activities of the M&E Program. The resultant lifestage periodicities encompass the majority of activity for a particular lifestage, and are not intended to be inclusive of every individual in the population (RMT 2013). Lifestage periodicities for fall-run Chinook salmon were developed through review of previously conducted studies, as well as recent and currently ongoing data collection activities of the Yuba Accord M&E Program. The resultant lifestage periodicities encompass the majority of activity for a particular lifestage, and are not intended to be inclusive of every individual in the population. The lifestage-specific periodicities for fall-run Chinook salmon are summarized in Table 6.1.1-1 and discussed below.

Table 6.1.1-1. Lifestage-specific periodicities for fall-run Chinook salmon in the lower Yuba River.

Lifestage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult Immigration and Staging	□□	□□	□□	□□	□□	□□	■■	■■	■■	■■	■■	■■
Spawning	□□	□□	□□	□□	□□	□□	□□	□□	□□	■■	■■	■■
Embryo Incubation	■■	■■	■■	□□	□□	□□	□□	□□	□□	■■	■■	■■
Juvenile Rearing and Downstream Movement	■■	■■	■■	■■	■■	■■	□□	□□	□□	□□	□□	□■

(Source: RMT 2013)

6.1.1.1 Adult Immigration and Staging

Adult fall-run Chinook salmon have been reported to enter the Sacramento and San Joaquin rivers from July through December, and to spawn from October through December (Reclamation 2008). Unlike spring-run Chinook salmon, adult fall-run Chinook salmon do not exhibit an extended over-summer holding period in the lower Yuba River (RMT 2010b). Rather, it is believed that they stage for a relatively short period of time prior to spawning. This conventional belief is supported by the recent evaluation by the RMT of the acoustic telemetry monitoring data and the VAKI Riverwatcher™ data (RMT 2013).

Adult fall-run Chinook salmon immigration and staging has been reported to generally occur in the lower Yuba River from August through November (CALFED and YCWA 2005), and immigration generally peaks in November, with typically greater than 90 percent of the run having entered the river by the end of November (CDFG 1992; CDFG 1995, both as cited in RMT 2010b). The RMT's review of available data indicates that fall-run Chinook salmon immigration generally extends from July through December. As indicated by the eight years of available data of fish passing through the VAKI Riverwatcher™ systems located in both ladders at Daguerre Point Dam, the average date associated with the median of adult fall-run Chinook salmon passing Daguerre Point Dam was October 14, and the average date by which 90 percent of the annual runs had passed the dam was November 17 (RMT 2013).

In general, a minimal amount of effort was expended by the RMT to differentiate between fall- and spring-run Chinook when acoustically-tagging adult immigrating Chinook salmon (RMT 2013). A total of eight individuals were acoustically-tagged below Daguerre Point Dam during October 2011. By contrast to phenotypic adult spring-run Chinook salmon, which exhibited extended periods of holding downstream of Daguerre Point Dam, the acoustically-tagged fall-run adult Chinook salmon held for an average of only about 3 days downstream of Daguerre Point Dam prior to passing upstream through the fish ladders. These data tend to generally confirm the understanding that adult fall-run Chinook salmon spend relatively short periods of time staging prior to migrating to spawning areas and commencing spawning activities (RMT 2013).

RMT (2013) identified an upper tolerable water temperature index (WTI) value of 68°F for the fall-run Chinook salmon adult immigration and staging lifestage.

6.1.1.2 Adult Spawning

The lower Yuba River fall-run Chinook salmon spawning period has been reported to extend from October through December (CALFED and YCWA 2005). Preliminary data from the recently conducted redd surveys, and back-calculations from previous and recent carcass surveys generally confirm this temporal distribution (RMT 2013).

According to RMT (2010b), fall-run Chinook salmon are primarily observed spawning during October in the upper reaches of the lower Yuba River upstream of Daguerre Point Dam. Spawning fall-run Chinook salmon begin expanding their spatial distribution further downstream in later fall months as suitable temperatures become available near or downstream of Daguerre

Point Dam (RMT 2010b). Recent analyses of available redd distribution and water temperature data confirm these previous characterizations (RMT 2013).

According to RMT (2013), for the periods analyzed from October through December (the fall-run Chinook salmon spawning period), the measure of central tendency of redd distribution continues to move downstream as the spawning season progresses from October through December. Also, redds were distributed farther downstream as water temperatures became cooler in late October, compared to early October (RMT 2013).

Fall-run Chinook salmon spawning activity appeared to be associated with water temperature. RMT (2013) identified an upper tolerable WTI value of 58°F for fall-run Chinook salmon spawning. For all Chinook salmon redds newly-constructed in the lower Yuba River during October through December of 2009 and 2010, about 97 percent were observed at locations where concurrent water temperature measurements were at or below the upper tolerable WTI value of 58°F (RMT 2013).

6.1.1.3 Embryo Incubation

The fall-run Chinook salmon embryo incubation period has been reported to extend from October through March (YCWA et al. 2007). Based upon consideration of accumulated thermal units from the time of egg deposition through hatching and alevin incubation, the RMT (2010b) therefore considered the fall-run Chinook salmon embryo incubation period to extend from October through March. This time period is consistent with observed trends in Chinook salmon fry captures in the RSTs, as previously described in RMT (2013). Review of recently available data and information, including updated fall-run Chinook salmon spawning spatial and temporal distributions, and recent water temperature monitoring information, confirms the general characterization of the fall-run Chinook salmon embryo incubation period as extending from October through March in the lower Yuba River (RMT 2013). RMT (2013) identified an upper tolerable WTI value of 58°F for the fall-run Chinook salmon embryo incubation lifestage.

6.1.1.4 Juvenile Rearing and Downstream Movement

Fall-run Chinook salmon juvenile rearing in the lower Yuba River has been reported to primarily occur from December through June (CALFED and YCWA 2005). In the lower Yuba River, most fall-run Chinook salmon reportedly exhibit downstream movement as fry shortly after emergence from gravels, although some individuals rear in the river for a period up to several months and move downstream as juveniles (RMT 2010b). According to RMT (2010b), in past years CDFW employed the run identification methodology to identify fall-run Chinook salmon juveniles captured in the RSTs. Based on CDFW's examination of run-specific determinations, in the lower Yuba River the majority (81.1%) of fall-run Chinook salmon move past the Hallwood Boulevard RST from December through March, with decreasing numbers captured during April (8.9%), May (6.6%), June (3.2%), and July (0.2%) (RMT 2010b, as cited in RMT 2013). Most of the fish captured from December through March were post-emergent fry (< 50 mm FL), while nearly all juvenile fall-run Chinook salmon captured from May through July were larger (≥ 50 mm FL) (YCWA et al. 2007). Thus, previous reports suggest that the fry rearing lifestage was considered to extend from December through April, and the juvenile rearing lifestage from March through June (RMT 2013).

The RMT has reviewed recently available data to further refine juvenile fall-run Chinook salmon lifestage periodicities. Based upon estimation of initial emergence in consideration of the ATUs required for embryo incubation to hatching, and upon size-at-time of juvenile Chinook salmon in the RSTs as previously discussed, the phenotypic fall-run Chinook salmon fry rearing period generally extends from mid-December through April, and the juvenile rearing lifestage extends from mid-January through June (RMT 2013). Juvenile downstream movement, which includes both fry and larger juveniles as indicated by captures in the Hallwood Boulevard RSTs, generally occurs from mid-December through June (RMT 2013). RMT (2013) identified an upper tolerable WTI value of 68°F for the fall-run Chinook salmon juvenile rearing and downstream movement lifestage.

6.1.1.5 Ocean Distribution

According to Reclamation (2008), Pacific salmon *Oncorhynchus spp*. tagged with coded-wire tags (CWTs) since 1981 have been recovered in commercial fisheries and research programs in the North Pacific Ocean, Gulf of Alaska, and Bering Sea-Aleutian Islands (Celewycz et al. 2007 in Reclamation 2008). The known range of North American Chinook salmon, as shown by tagging experiments, extends across almost the entire Bering Sea, north to 60°03’N and west to 172°12’E. In the North Pacific, the known ocean range of North American Chinook salmon extends north from about 40°N (in the coastal waters just off California) and west to the waters just south of Adak Island in the central Aleutians (176°34’W, 51°29’N)(Celewycz et al. 2007 in Reclamation 2008).

Pacific salmon spend most of their life cycles in the nutrient-rich North Pacific Ocean. Along the California coast, adult Chinook salmon are key predators, responding in their distribution and abundance to availability of food resources (Adams 2001 in Reclamation 2008). Fall-run Chinook salmon normally spend 2 to 4 years in the ocean, although Feather River salmon normally have a 4 to 5 year ocean residency (Moyle 2002). Available data suggest that, while in the ocean, fall-run Chinook salmon primarily remain in the coastal waters off California (NMFS 1997 in Reclamation 2008). Chinook salmon typically move into the Gulf of the Farallones in February and March, and are generally found off the Golden Gate from Bolinas Point in the north to Point San Pedro in the south (Reclamation 2008). Their diets consist of Pacific herring (recently emigrated from the San Francisco Bay after November to February spawning) and anchovies. Herring are particularly vulnerable to Chinook salmon predation as they are weakened from spawning. Chinook salmon may move offshore again in April to June to feed on euphausiid shrimp *Thysanoessa spinifera* (i.e., krill), crab larvae, and juvenile rockfish and, then return to the near-shore in July to forage exclusively on anchovy. The distribution of adult Chinook salmon and their stomach contents strongly relate to the availability and composition of food resources, such as anchovy, and the availability of those food resources is related to climatic and ocean conditions (Reclamation 2008).

During February and March, anchovies begin to gather in near-shore waters before their migration into the San Francisco Bay, which occurs during April and represents the transition time in Chinook salmon near-shore and offshore feeding habits. Euphausiids are taken as prey by Chinook salmon during April and May (Adams 2001 in Reclamation 2008). Dungeness crab (C*ancer magister)* megalopa larvae dominate the diets of Chinook salmon for a short time period, during their last pelagic phase in early April. In May and June, Chinook salmon move further offshore and start feeding on euphausiids and juvenile rockfish (Reclamation 2008). In years when juvenile rockfish are abundant, they are the preferred prey and dominate the Chinook salmon diet, whereas in low abundance years, Chinook salmon feed mainly on euphausiids (Reclamation 2008). Later in the summer the Gulf water warms due to the absence of upwelling, and anchovies simultaneously move out of the San Francisco Bay and into the Gulf of the Farallones. This is coupled with a seasonal disappearance of juvenile rockfish, causing the salmon to return to the near-shore and capitalize on the feeding opportunity presented by the anchovies. Diet information has confirmed the salmon's dependence on aggregations of prey, and the prevalence of opportunistic feeding (Adams 2001 in Reclamation 2008). This natural concentration of Chinook salmon makes them susceptible to increased angling take (Reclamation 2008). However, the dependence on these traditional prey complexes may be disrupted during strong El Niños or other changes to ocean conditions. When prey aggregations fail to occur, the condition (length-to-weight relationship) may decrease similar to what was recorded during California's commercial salmon catch in El Niño years (Reclamation 2008).

Ocean conditions are likely an important cause of density-independent mortality and interannual fluctuations in escapement sizes. Most mortality experienced by salmonids during the marine phase occurs soon after ocean entry (Pearcy 1992, Mantua et al. 1997 both as cited in SJRRP 2009).

6.1.2 Historical Distribution and Abundance

Historically, fall-run Chinook salmon were one of the more abundant salmon runs in the Central Valley, and used the major rivers and their 21 tributaries in the Central Valley from the Kings River in the south to the Pit and McCloud rivers in the north (Schick et al. 2005 as cited in Reclamation 2008). Late fall-run Chinook salmon probably used the Sacramento River and tributaries above Shasta Dam (Moyle et al. 1995). Counts of adult salmon as they passed over the Anderson-Cottonwood Irrigation District (ACID) Dam were obtained as early as 1937, but complete estimates of fall-run Chinook salmon abundance in the Sacramento River and its major tributaries were not made until 1953 (USFWS 1995). The late fall-run was identified as separate from the fall-run in the Sacramento River after the Red Bluff Diversion Dam (RBDD) was constructed in 1966 and fish counts could be more accurately made at the RBDD fish ladder (Reclamation 2008).

According to Yoshiyama et al. (2001), fall-run Chinook salmon historically spawned primarily in the mainstem Feather River downstream of Oroville Reservoir, and Fry (1961) reported fall-run Chinook salmon escapement estimates of 10,000 to 86,000 between 1940 and 1959. Reclamation (2008) reports that Feather River fall-run Chinook salmon population trends continue to show annual variability, but are more stable than before Oroville Dam was completed. Pre-dam escapement levels in the Feather River averaged about 41,000 fish compared to about 46,000 thereafter, although this increase appears to be a result of hatchery production in the system (Reclamation 2008).

Annual run sizes of fall- and late fall-run Chinook salmon are reported in “GrandTab", a database administered by CDFW for the Central Valley that includes reported run size estimates from 1952 through 2010 for fall-run Chinook salmon and from 1970 through 2010 for late fall-run Chinook salmon. The Central Valley fall-/late fall-run Chinook salmon ESU has displayed broad fluctuations in adult abundance. Between 1959 and 1970, escapement of fall-run Chinook salmon in the mainstem Sacramento River exceeded 100,000 fish every year except for one year (1967). Since 1970, escapement generally has not exceeded 100,000 (Reclamation 2008). More recent estimates of fall-run Chinook salmon in the Sacramento River and its tributaries (not including the lower Yuba and Feather rivers because GrandTab does not distinguish between fall-run and spring-run Chinook salmon in-river spawners, and not including the FRFH) have ranged from 30,128 in 2009 to 685,179 in 2002.

The average abundance for the Sacramento River and its tributaries (excluding the lower Yuba and Feather rivers – see above) was 134,694 for the period extending from 1970 through 1979, 155,282 for the period 1980 through 1989, 177,994 for the period 1990 through 1999, and 252,614 for the period 2000 through 2010.

Although fall-run Chinook salmon is an important commercial and recreational fish species, recent declines in populations of this species have resulted in harvest management restrictions. Due to a very low returns of fall-run Chinook salmon to the Central Valley in 2007 and 2008, there was a complete closure of the commercial and recreational ocean Chinook salmon fishery in 2008 and 2009 (Lindley et al. 2009). Only 66,000 spawners are estimated to have returned to natural areas and hatcheries in 2008 (Lindley et al. 2009). In April 2009, the PFMC and NMFS adopted a closure of all commercial ocean salmon fishing through April 30, 2010, and placed restrictions on inland salmon fisheries (CDFG 2009). As shown in Table 6.1.2-1, abundance estimates of fall-run Chinook salmon in 2010 were greater than 2009 estimates for all California Central Valley watersheds that monitor fall-run Chinook salmon (RMT 2010a). Fishing in 2010 was also constrained for the same reasons as in the previous two years (CDFG 2011).

In 2011, both CDFW and PFMC approved reopening the commercial and recreational fishing season based on scientific information suggesting that the Sacramento River fall-run Chinook salmon ocean population size was more than 700,000 fish — almost triple the 2010 forecast (CDFG 2011). CDFG (2011) reported that “…[CDFG and PFMC] *are cautiously optimistic that Sacramento River salmon stocks have recovered to the point that fisheries this year — our California sport and commercial ocean fisheries as well as river fisheries — can be sustained while still being confident that enough fish will return to natural spawning grounds and hatcheries to reproduce next fall*.”

Historically, the Yuba River watershed reportedly was one of the most productive habitats for runs of Chinook salmon (Yoshiyama et al. 1996). Although it is not possible to estimate the numbers of spawning fish from historical data, CDFG (1993) suggested that the Yuba River “*historically supported up to 15 percent of the annual run of fall-run Chinook salmon in the Sacramento River system*” (Yoshiyama et al. 1996).

Table 6.1.2-1. Fall-run Chinook salmon escapement estimates from 1994-2012 for rivers in the California Central Valley (GrandTab 2013).

Year	Sacramento River Mainstem	Battle Creek	Clear Creek	Cottonwood Creek	Cow Creek	Bear Creek	Mill Creek	Deer Creek	Butte Creek	Feather River	Yuba River	American River	Cosumnes River	Mokelumne River	Stanislaus River	Tuolumne River	Merced River
1994	58,546	24,274	2,546				1,081	307		38,382	10,890	33,598		1,238	1,031	506	2,646
1995	63,934	56,515	9,298						445	59,912	14,237 *	70,618		2,194	619	827	2,320
1996	84,086	52,409	5,922						500	57,170	27,900	69,745		4,038	168	4,362	3,291
1997	119,296	50,744	8,569				478	1,203	800	50,547	25,948	47,195		3,681	5,588	7,146	2,714
1998	6,318	53,957	4,259				546	270	500		31,090	50,457	300	4,122	3,087	8,910	3,292
1999	161,192	92,929	8,003								24,230	55,339	229	2,183	4,349	8,232	3,129
2000	96,688	53,447	6,687							114,717	14,995	100,852	460	1,973	8,498	17,873	11,130
2001	75,296	100,604	10,865						4,433	178,645	23,392	135,384		2,307	7,033	8,782	9,181
2002	65,690	397,149	16,071				2,611		3,665	105,163	24,051	124,252	1,350	2,840	7,787	7,173	8,866
2003	89,229	64,764	9,475				2,426		3,492	89,946	28,316	163,742	122	2,122	5,902	2,163	2,530
2004	43,604	23,861	6,365				1,192	300	2,516	54,171	15,269	99,230	1,208	1,588	4,015	1,984	3,270
2005	57,012	20,520	14,824				2,426	963	4,255	49,160	17,630	62,679	370	10,406	1,427	668	1,942
2006	55,468	19,493	8,422		4,209		1,403	1,905	1,920	76,414	8,121	24,540	530	1,732	1,923	562	1,429
2007	17,061	9,904	4,157	1,250	2,044	140	851	563	1,225	21,909	2,604	10,120	77	470	443	224	485
2008	24,743	4,286	7,677	510	478	19	218	194	275	5,939	3,508	2,514	15	173	865	388	389
2009	5,827	3,047	3,228	1,055	261	6	102	58	306	4,847	4,635	5,297		680	595	124	358
2010	16,372	6,632	7,192	1,137	536		144	166	370	44,914	14,375	14,688	740	1,920	1,086	540	651
2011	11,957	12,513	4,841	2,144	1,810		1,231	662	416	47,289	8,928	25,626	53	2,674	1,309	893	1,571
2012	28,701	31,554	7,631	2,556	1,488		890	873	813	63,649	7,668	38,328	1,071	5,471	4,006	783	2,011

* Survey method not compatible. Estimate includes assumed 15.5% contribution to annual escapement from Rose Bar to SR 20 Bridge.

Historic trends in distribution and abundance of Yuba River Chinook salmon during three periods: (1) pre-dam period (pre-1904); (2) dam construction period (1906-1969); and (3) post-Yuba River Development Project (post-1970) are summarized below.

During the pre-dam period, Chinook salmon had access to much of their historic spawning and rearing habitat and, based on anecdotal accounts, ascended considerable distances up the South, Middle, and North Forks of the Yuba River (Yoshiyama et al. 1996). Although trends in fish abundance during this period were not documented, significant declines in Chinook salmon abundance probably occurred as a result of extensive habitat destruction resulting from hydraulic mining during the mid-to-late 1800s (SWRI et al. 2000). The massive influx of sediment caused profound changes in the channel and floodplain of the lower Yuba River which has continued to adversely affected fishery resources to the present day.

During the dam construction period, the California Debris Commission constructed a series of dams in the lower Yuba River to capture hydraulic mining debris and prevent its transport to navigable river reaches on the valley floor. These dams resulted in severe, long-term impacts on Chinook salmon populations in the Yuba River by forming complete or partial barriers to migration and eliminating access to much of the historic spawning and rearing habitat. Englebright Dam, completed in 1941, blocked spawning runs of Chinook salmon to upper portions of the mainstem Yuba River and its tributaries. Fall-run Chinook salmon were adversely affected but population declines were probably less severe than those of spring-run Chinook salmon because a significant portion of fall-run Chinook salmon historic spawning and rearing habitat remained accessible below the dams.

CDFW began making annual estimates of fall-run Chinook salmon spawning escapement (the number of salmon that "escape" the commercial and sport fisheries in the Pacific Ocean and return to spawn in the lower Yuba River) in 1953. From 1953 to 1971, these estimates ranged from 1,000 fish in 1957 to 37,000 fish in 1963 and averaged 12,906 fish (YCWA et al. 2007). Since 1970, operation of New Bullards Bar Dam on the North Fork of the Yuba River has modified the seasonal flow and temperature patterns in the lower Yuba River below Englebright Dam (SWRI et al. 2000). Compared to pre-New Bullards Bar Dam conditions, flows have

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generally decreased in the spring, increased in the summer and fall, and remained the same in the winter. These changes have been accompanied by a general increase in water temperatures in the spring, a decrease in the summer and fall, and little or no change in the winter. A multiple-level outlet was installed at the dam during construction to control the temperatures of downstream discharges (SWRI et al. 2000) although by agreement with Cal Fish and Wildlife, YCWA uses the lower level outlet exclusively.

From 1972 to 2004, the annual average run of Chinook salmon was 16,004 fish (YCWA et al. 2007). Assuming CDFW's traditional 15.5 percent estimated contribution to total escapement, the average for the 1972-2004 period would be 14,749 fish (YCWA et al. 2007). It is important to note that a direct comparison between survey years is complicated by inconsistent experimental methodologies. For example, early CDFW studies often covered a limited portion of the spawning area or spawning period. Since 1953, mark-recapture carcass surveys have been conducted on the lower Yuba River to estimate escapement (or abundance), although methods have varied considerably (RMT 2010a). Historical reports list non-uniform sampling procedures including differing survey reach demarcations, varying survey duration and sampling areas. Different mark-recapture models were used for escapement estimation (i.e., Petersen, Jolly-Seber, modified-Schaefer) over the years. Standardized mark and recapture (Schaefer) methods were not utilized until about 1978 (J. Nelson, CDFG, 2006, pers comm.), and it is difficult to determine the specific methods utilized to expand direct observations during the earlier studies (YCWA et al. 2007). Additionally, the lower Yuba River from the Narrows Pool downstream to the State Route 20 (SR20) Bridge (also referred to as the Blue Point Mine Reach or Rose Bar Reach) was not surveyed from 1973-1993 (Nelson and Hill 1995 in RMT 2010a). Surveys were frequently attempted on this reach, but seldom were completed because of inclement weather, inaccessibility or turbid storm flows. As a result, most escapement estimates from this survey section have been rejected due to low statistical confidence. In lieu of data-driven estimates, CDFW applied a 15.5 percent expansion to the total lower Yuba River estimate (SR20-Feather River confluence) to produce escapement estimates above SR20 from 1973-1993 (Nelson and Hill 1995 in RMT 2010a). Recent surveys (1994 and 1996-present) have been more consistent in both duration and area of survey (RMT 2010a).

From about 1953 to 2000, Yuba River fall-run Chinook salmon escapement has been sustained and, in recent years has increased to levels exceeding those that occurred prior to the operation of New Bullards Bar Reservoir (SWRI et al. 2000). The fall-run Chinook salmon population in the Yuba River was substantially reduced before the 1950s by extensive mining, agriculture, urbanization, and commercial fishing (YCWA et al. 2007). Since 1950 natural production of fall-run Chinook salmon in the lower Yuba River has sustained or slightly increased the average population levels despite continued and increasing out-of-basin stressors that have acted to further limit survival of Chinook salmon in the lower Sacramento River, Delta and Pacific Ocean (YCWA et al. 2007).

6.1.3 Population Status and Trends

6.1.3.1 Central Valley

In the Central Valley, fall-run Chinook salmon are the most numerous of the four salmon runs, and continue to support commercial and recreational fisheries of significant economic importance. Fall-run Chinook salmon is currently the largest run of Chinook salmon utilizing the Sacramento River system. The Feather and Yuba rivers and San Joaquin River tributaries also support runs of fall-run Chinook salmon. Central Valley-wide fall- and late fall-run Chinook salmon abundance estimates are available through GrandTab (CDFG 2011). Since 1983, in-river estimates for the lower Feather River have not been included in the system-wide estimates, although FRFH estimates are provided separately. Additionally, spring-run Chinook salmon are not estimated in GrandTab for the lower Yuba River, and all lower Yuba River Chinook salmon escapement estimates are reported as fall-run Chinook salmon. For the Sacramento River system (not including the FRFH or the lower Yuba River) since 1996, fall-run Chinook salmon run size estimates have ranged from a high of 738,652 in 2002 to a low of 28,669 in 2009. The abundance of in-river spawning Central Valley fall-run Chinook salmon steadily declined from 2002 through 2009, with gradual increases during 2010, 2011 and 2012, with a total abundance of 106,526 fish, 117,417 fish, and 184,151 fish, respectively, in those years.

Table 6.1.3-1. Fall-run Chinook salmon abundance from 1996 through 2010 in the Sacramento River system.

Year	FALL-RUN CHINOOK SALMON IN SACRAMENTO RIVER SYSTEM					
	Keswick Dam to Red Bluff Diversion Dam		Red Bluff Diversion Dam to Princeton Ferry		Princeton Ferry to Sacramento	
	Sacramento River Mainstem	Sacramento River Tributaries(1)	Sacramento River Mainstem	Sacramento River Tributaries(2)	Sacramento River Mainstem	Sacramento River Tributaries(3)
1996	71,725	58,331	12,361	0	---	155,315
1997	98,765	59,313	20,531	1,681	---	124,490
1998	5,718	58,216	600	816	---	82,047
1999	133,365	100,932	27,827	0	---	79,569
2000	87,793	60,134	8,895	0	---	230,564
2001	57,920	111,469	17,376	0	---	341,854
2002	45,552	413,220	20,138	2,611	---	257,131
2003	66,485	74,239	22,744	2,426	---	285,496
2004	34,050	30,226	9,554	1,492	---	171,186
2005	44,950	35,344	12,062	3,389	---	133,724
2006	46,568	32,124	8,900	3,308	---	110,995
2007	14,097	17,495	2,964	1,414	---	35,858
2008	23,134	12,970	1,609	412	---	12,236
2009	5,311	7,597	516	160	---	15,085
2010	13,824	15,497	2,548	310	---	74,347
2011	10,623	21,308	1,334	1,893	---	82,259
2012	22,435	43,229	6,266	1,763	---	110,458

(1) Tributaries include Battle Creek, Clear Creek, Cotton-wood Creek, Cow Creek and Bear Creek
(2) Tributaries include Mill Creek and Deer Creek
(3) Tributaries include Butte Creek, Feather River, Yuba River and American River

Overall, progress in achieving the Chinook salmon production targets called for in the CVPIA has become increasing difficult since 2000 (USDOI 2010). In 2000, 44 percent of the watersheds that were monitored exceeded their AFRP production target, whereas only 8 percent of the monitored watersheds exceeded their AFRP target by 2009 (USDOI 2010). As discussed in USDOI (2010), the causal factors for the recent decline in the abundance of fall-run Chinook salmon from the Central Valley have been the subject of substantial debate and analysis. The historical and current factors affecting the runs have been described by several authors (e.g., Yoshiyama et al. 1998; Moyle 2002; NMFS 2009). These factors (in no particular order) include, but are not limited to:

- The construction of dams and water diversion infrastructure, which have eliminated historical salmon spawning areas or altered hydrologic conditions.
- Harvest of adult salmon in the ocean and natal watersheds.
- Entrainment of juvenile salmon by water diversion infrastructure.
- Loss of juvenile salmon floodplain and estuarine rearing habitat through diking and draining of habitat.
- Enhanced predation of juvenile salmon, particularly by non-native fish species.
- A variety of effects relating to the hatchery production of juvenile salmon (e.g., changes in the genetic diversity of a native salmon stock due to introgression with hatchery-produced salmon).
- Elevated incidents of diseases that may affect adult and juvenile salmon.
- Pollution.
- Losses of riparian cover that lead to elevated temperature regimes in the areas where adult and juvenile salmon could occur.
- Siltation of spawning areas where juvenile salmon hatch or rear.
- Introduced species that change the processes and function in the ecosystem where salmon occur.
- Factors that include long periods of drought, extreme flood events, and periods of low ocean productivity.

In a comprehensive review, Lindley et al. (2009) identified specific factors that were probably responsible for the large decline in the numbers of adult fall-run Chinook salmon that returned to the Central Valley in 2007 and 2008. The proximate cause for the decline probably consisted of anomalous conditions in the coastal portion of the Pacific Ocean in 2005 and 2006 which then resulted in unusually poor survival of the 2004 and 2005 broods of juvenile fall-run Chinook salmon that had migrated to the ocean (USDOI 2010). Some of the anomalous conditions in the ocean that may have caused the poor survival of juvenile Chinook salmon entering the Pacific Ocean include weak upwelling of ocean water which resulted in low primary productivity, warm sea surface temperatures that may have led to a general reduction in fish health, and low densities of the prey items that juvenile salmon consume (USDOI 2010). Lindley et al. (2009) also suggest other factors likely compounded the problems created by unusual ocean conditions. These include, in descending order of importance:

- The ongoing degradation of freshwater and estuarine habitats that juvenile salmon depend upon for rearing and growth.

- The production of juvenile fall-run Chinook salmon at five fish hatcheries in the Central Valley that have contributed to the loss of genetic diversity in, and therefore the fitness of, native salmon populations.
- Inaccurate forecasts of the number of adult salmon that were projected to return to the Central Valley to spawn, and the subsequent establishment of harvest levels that overestimated the number of adult salmon that could be harvested on a sustainable basis.

According to USDOI (2010), some of the factors responsible for reductions in Chinook salmon populations can be minimized through restoration actions conducted pursuant to the CVPIA. For example, adverse effects related to changes in the quality of gravel substrates where salmon eggs are laid, hydrologic conditions, entrainment of juvenile salmon, and the loss of juvenile salmon rearing habitat can be minimized by management actions (e.g., Spawning Gravel Program, Dedicated Project Yield Program, Anadromous Fish Screen Program, and AFRP). It is not clear, however, if the cumulative benefits created by these restoration programs and other programs administered by entities such as the CDFW or NMFS can successfully offset conditions in the ocean where salmon spend approximately two-thirds of their lives (USDOI 2010).

In summary, Central Valley Chinook salmon constitute the majority of salmon produced in California and at times have accounted for 70 percent or more of the State-wide commercial harvest (Yoshiyama et al. 2001). According to NMFS (2009a), fall-run Chinook salmon on the mainstem Sacramento River have shown a steady decline in abundance since 1999. This long-term trend is partly attributed to operating Shasta Dam releases for temperature control and ramp downs in the fall to conserve storage. Shasta Dam releases are typically reduced in the fall to conserve storage after the irrigation season, and this reduction in fall flows can strand and dewater Chinook salmon redds that are located in shallow riffle areas in the upper Sacramento River (Red Bluff Diversion Dam to Keswick Dam). More recently, the decline in fall-run Chinook salmon is consistent with Central Valley-wide declines attributed to poor ocean conditions (NMFS 2007).

Fall-run Chinook salmon from the Yuba River are classified as “rebuilding” (Reclamation 2008). In 2010, eight watersheds, including the Yuba River, were classified as experiencing an increase in the average natural production of fall-run Chinook salmon over time (USDOI 2010).

6.1.3.2 Lower Yuba River

Since 2003, infrared-imaging technology has been used to monitor fish passage at Daguerre Point Dam in the lower Yuba River using VAKI Riverwatcher™ systems to document specific observations addressing VSP parameters of adult Chinook salmon abundance and diversity. The VAKI Riverwatcher™ system records both silhouettes and electronic images of each fish passage event. By capturing silhouettes and images, fish passage can be accurately monitored even under turbid conditions.

In the lower Yuba River, fall-run Chinook salmon was differentiated from spring-run Chinook salmon utilizing VAKI Riverwatcher™ data counts of Chinook salmon passing upstream of Daguerre Point Dam and an analysis of temporal modality applied to the annual distributions of daily number of Chinook salmon passing upstream of Daguerre Point Dam that resulted from the reduction of the VAKI Riverwatcher™ hourly counts. There are several steps included in this process, which are described in Chapter 5 of the Applicant-Prepared Draft BA.

Table 6.1.3-2 displays the results of the above calculations for the 2004-2011 run sizes of lower Yuba River Chinook salmon, and the spring-run and fall-run Chinook salmon in-river spawners reported by GrandTab for the Sacramento River system (RMT 2013).

Table 6.1.3-2. Estimated number of phenotypic spring-run and fall-run Chinook salmon spawning in the lower Yuba River from 2004 through 2011, and corresponding spring-run and fall-run Chinook salmon spawners reported in GrandTab for Sacramento River system.

Year	Yuba River Spring-run Chinook Salmon Spawners (No.of Fish)	Yuba River Fall-run Chinook Salmon Spawners (No.of Fish)	Sacramento River System (GrandTab)	
			Spring-run Chinook Salmon Spawners (No.of Fish)	Fall-run Chinook Salmon Spawners (No.of Fish)
2004	1,180	13,406	18,715	267,521
2005	3,889	13,741	17,959	253,785
2006	1,382	6,849	19,045	249,553
2007	562	2,042	14,602	76,299
2008	691	2,817	6,234	49,863
2009	540	4,255	3,250	28,006
2010	4,364	8,733	5,580	130,168
2011	1,159	8,024	5,756	150,393

It is recognized that this approach to separate the annual GrandTab run sizes of lower Yuba River Chinook salmon spawners into spring-run and fall-run annual estimates is rather simplistic and results in only crude estimates. The existence of unavoidable differences in accuracy and precision between the estimates generated from the carcass surveys and the VAKI Riverwatcher™ counts may affect the accuracy and precision of the resulting estimates of phenotypic spring-run Chinook salmon that spawn in the lower Yuba River. These estimates based on GrandTab data were developed only to obtain a more equitable basis of comparison with the Sacramento River system.

The estimated numbers of lower Yuba River fall-run Chinook salmon spawners in Table 6.1.3.2-1 were used to evaluate their percent contribution to the in-river spawning population of fall-run Chinook salmon in the Sacramento River system (i.e., the fall-run Chinook salmon reported by GrandTab for the Sacramento River mainstem and tributaries) during the period of 2004-2011. The lowest contribution of lower Yuba River fall-run Chinook salmon to the Sacramento River system occurred in 2007 (3%). The lower Yuba River percent contribution increased each year from 2007 through 2009, reaching its maximum percent contribution during 2009 (15%). During 2010 and 2011, the percent contribution of the lower Yuba River ranged between 7 percent and 5 percent, respectively.

6.2 Limiting Factors, Threats and Stressors

Chapter 5 of the Applicant-Prepared Draft BA addresses limiting factors and threats for the spring-run Chinook salmon ESU, and their specific geographic influences, including the Sacramento River and the Delta, are also generally applicable to the fall-/late fall-run Chinook salmon ESU. Stressors that are unique to fall-run Chinook salmon EFH in the lower Yuba River, or substantially differ in the severity from the stressors previously described in Chapter 5 of the Applicant-Prepared Draft BA, are described below.

6.2.1 Pacific Coast Salmon

PFMC (1999) states that to maintain or restore habitat necessary for a sustainable salmon fishery requires the biophysical processes producing properly functioning habitat be maintained or restored. However, because watersheds and rivers differ in their characteristics (e.g., flow, water temperature, sedimentation, nutrient levels, physical structure, biological components), specific habitat requirements of salmonids differ among species, and change with seasonality and lifestage. Table 6.2.1-1 presents the general major habitat requirements and habitat concerns during each lifestage of Chinook salmon. According to PFMC (1999), salmonid habitat requirements should be met by maintaining habitat features within the natural range of patterns and processes that define the properly functioning habitat conditions within which salmon can exist.

Under the MSFCMA, NMFS and PFMC have more recently identified non-fishing activities that may adversely affect EFH, as well as actions to encourage the conservation and enhancement of EFH, including recommended options to avoid, minimize, or mitigate for the adverse effects identified in the FMP. Amendment 14 includes 21 such activities and conservation measures, and 10 additional non-fishing threats (Table 6.2.1-2) were identified by NMFS and PFMC (2011) during the 5-Year EFH Review. Each of the non-fishing-related activities in Table 6.1.5.1-2 may directly, indirectly, or cumulatively, temporarily or permanently, threaten the physical, chemical, and biological properties of the habitat utilized by salmonid species and/or their prey. The direct results of these threats is that salmonid EFH may be eliminated, diminished or disrupted (PFMC 1999).

Presently, conservations measures to address the 10 new threats have not been developed by PFMC or NMFS. If the PFMC decides to amend the Pacific Coast Salmon FMP in the future, then the descriptions of all 31 threats will be expanded upon and refined, and conservation measures developed for each threat (NMFS and PFMC 2011).

Table 6.2.1-1. Lifestage-specific habitat concerns associated with Pacific Coast salmon EFH (PFMC 1999).

ADULT IMMIGRATION PATHWAYS	
Passage blockage (e.g., culverts, dams)	Reduced frequency of holding pools
Water quality (high temperatures, pollutants)	Lack of cover, reduced depth of holding pool
High flows/low flows/water diversions	Reduced cold-water refugia
Channel modification/simplification	Increased predation resulting from habitat modification
SPAWNING AND EMBYRO INCUBATION	
Availability of spawning gravel of suitable size	Redd dewatering
Siltation of spawning gravels	Temperature/water quality problems
Redd scour caused by high flows	Redd disturbance from trampling (human, animal)
JUVENILE REARING HABITAT	
Diminished pool frequency, area, or depth	Low water flows/high water flows
Temperature/water quality problems	Nutrient availability
Diminished prey/competition for prey	Diminished channel complexity and cover
Blockage of access to habitat (upstream or down)	Predation caused by habitat simplification or loss of cover
Loss of off-channel areas, wetlands	
JUVENILE AND SMOLT EMIGRATION PATHWAYS	
Water quality	Passage blockage/diversion away from stream
Low water flows/high water flows	Increased predation as a result of habitat simplification or modification
Altered timing/quantity of water flows	
ESTUARINE HABITAT	
Water quality	Loss of channels, eel grass beds, woody debris
Altered timing/quantity of fresh water in-flow	Diminished prey/competition for prey

Table 6.2.1-1. (continued)

ESTUARINE HABITAT	
Loss of habitat resulting from diking dredging, filling	Increased predation as a result of habitat simplification or modification
Diminished habitat complexity	
MARINE HABITAT	
Water quality	Diminished prey/competition for prey
Increased predation	Altered timing/quantity/composition of river water plumes

Table 6.2.1-2. Non-fishing threats to Pacific Coast salmon EFH. Newly identified threats appear in the right column. Detailed information on the threats identified in the first column can be found in Amendment 14.

Threats Identified in Amendment 14 (1999)	New Threats Identified During the EFH 5-Year Review (2011)
Agriculture	Pile Driving
Artificial Propagation of Fish and Shellfish	Over-Water Structures
Bank Stabilization	Alternative Energy Development
Beaver Removal and Habitat Alteration	Liquefied Natural Gas Projects
Construction/Urbanization	Desalination
Dam Construction/Operation	Power Plant Intakes
Dredging and Dredged Spoil Disposal	Pesticide Use
Estuarine Alteration	Flood Control Maintenance
Forestry	Culvert Construction
Grazing	Climate Change
Habitat Restoration Projects	
Irrigation/Water Management	
Mineral Mining	
Introduction/Spread of Nonnative Species	
Offshore Oil and Gas Drilling	
Road Building and Maintenance	
Sand and Gravel Mining	
Vessel Operation	
Wastewater/Pollutant Discharge	
Wetland and Floodplain Alteration	
Woody Debris/Structure Removal	

Dams and reservoirs influence water temperatures through storage, diversion, and irrigation return flows, and changes in water temperatures can have significant implications for anadromous fish survival. Elevated water temperatures can stress all lifestages of anadromous fish, increase the risk of disease and mortality, affect toxicological responses to pollutants, and can cause migrating adult salmon to stop or delay their migrations and juvenile steelhead to residualize. Warm water temperatures also increase the foraging rate of predatory fish thereby increasing the consumption of smolts (NMFS 2008).

Chinook salmon survival through migration corridors generally declines with distance traveled, whether due to natural hazards (including predation), mortality due to passage facilities, or other factors associated with development (e.g., water quality) (NMFS 2008). According to NMFS (2008), increased travel time (i.e., migration delay) presents an array of potential survival hazards to migrating juvenile Chinook salmon, including: (1) increased exposure to potential mortality vectors (e.g. predation, disease, thermal stress); (2) disruption of arrival timing to the Delta (which likely affects predator/prey relationships); (3) depletion of energy reserves; (4) potential metabolic problems associated with smoltification; and (5) increased contribution to residualism (i.e., loss of migratory behavior).

6.2.2 Central Valley Chinook Salmon

In the EFH Assessment prepared by Reclamation (2008) and in the resultant EFH conservation recommendations in NMFS (2009), it was concluded that the projected impacts of CVP/SWP system-wide operations are expected to eliminate, diminish, and/or disrupt many EFH habitat functions for the fall-/late fall-run Chinook salmon ESU throughout the Central Valley, as described below.

Opportunities to avoid or minimize adverse affects to EFH in a specific project area may be constrained, and the potential for substantive habitat gains in these areas is minimal (NMFS 2009a). Yoshiyama et al. (2001) noted that the primary cause in the reduction of instream habitat for Chinook salmon has been the construction of dams and other barriers. Many of the direct adverse impacts to fall- and late-fall run Chinook salmon EFH, or the indirect impacts caused by these runs to the EFH of other Chinook runs, could be alleviated if fish passage were provided (NMFS 2009a). In Central Valley watersheds, dams block 95 percent of historic salmonid spawning habitat (NMFM 2009a). Additionally, non-Federal FERC-licensed dams account for approximately 40 percent of all surface water storage in the Central Valley. As a result, Chinook salmon are extirpated from approximately 5,700 miles of their historic habitat in the Central Valley. In most cases the habitat remaining is restricted to the valley floor where it was historically limited to seasonal migration use only. Remnant populations below these dams are now subject to intensive river regulation and to further direct and indirect impacts of hydroelectric operations (NMFS 2009a).

The Sacramento River is constrained by levees along much of the lower reaches. Stressors identified in the Sacramento River include high water temperatures, a modified hydrograph, simplified instream habitat, diversion dams, predation, and harvest. Water temperature and flow fluctuation are the main short-term factors affected by the ongoing operation of the CVP and SWP water projects (Reclamation 2008). According to NMFS (2009a), fall-/late fall-run Chinook salmon spawning in the upper Sacramento River is adversely affected in all years when flows are kept high for agricultural demand (i.e., rice decomposition) and then decreased in the fall to conserve water in Shasta Reservoir. Large numbers of fall-run Chinook salmon redds have been dewatered in the upper Sacramento River when flows are lowered after the rice decomposition program is completed and Shasta Dam releases decrease. Consequently, it is anticipated that some redd dewatering will continue in the future (NMFS 2009a).

According to NMFS (2009a), CVP/SWP system-wide operations in the Central Valley reduce adult reproductive success and increase mortality of early lifestage (egg through smolt) fall- and late fall-run Chinook salmon. NMFS (2009a) considered the net effects of CVP/SWP project operations and hatchery production in the short-term, and also separately considered the long-term effects of hatchery production on fall-run Chinook salmon, determining that hatchery practices could diminish the productivity, distribution and diversity of non-listed stocks (e.g., fall-run Chinook salmon) over the long-term. NMFS (2009a) evaluated the potential changes in freshwater mortality sources for Central Valley fall-/late fall-run Chinook salmon attributed to CVP/SWP operations. Mortality sources included elevated water temperatures, low flows upstream, and direct entrainment in the Delta. Other effects of CVP/SWP project operations on fall-/late fall-run Chinook salmon or its habitat included fish stranding, redd dewatering and predation (NMFS 2009a).

Hatchery practices, as well as spatial and temporal overlaps of habitat use and spawning activity between spring- and fall-run fish have led to the hybridization and homogenization of some subpopulations (CDFG 1998). As early as the 1960s, Slater (1963) observed that spring-run and early fall-run were competing for spawning sites in the Sacramento River below Keswick Dam, and speculated that the two runs may have hybridized. Spring-run from the FRFH have been documented as straying throughout the Central Valley for many years (CDFG 1998), and in many cases have been recovered from the spawning grounds of fall-run, an indication that FRFH spring-run may exhibit fall-run life history characteristics. Although the degree of hybridization has not been comprehensively determined, it is clear that the populations of spring-run spawning Chinook salmon in the Feather River and counted at RBDD contain hybridized fish (NMFS 2009).

Outmigrating Chinook salmon juveniles are also subjected to potential entrainment from water diversions located along the Sacramento River — of the 879 diversions only 91 (11%) currently have fish screens (Calfish database and AFSP 2009 annual report, as cited in NMFS 2009a). These diversions adversely affect EFH by disrupting migration, diverting juveniles into unsuitable rearing habitat, and killing fish outright. The RPA described in NMFS (2009) insures that continued funding of fish screens will continue through the AFRP to reduce entrainment at unscreened diversions (NMFS 2009a).

Juvenile fall- and late-run Chinook salmon typically migrate down the Sacramento River through the highly productive feeding grounds of the Delta, to the San Francisco Estuary and towards the Pacific Ocean. Based on the mainly ocean-type life history observed (i.e., fall-run), MacFarlane and Norton (2002) concluded that unlike other salmonid populations in the Pacific Northwest, Central Valley Chinook salmon show little estuarine dependence and may benefit from expedited ocean entry (NMFS 2009). Nevertheless, Chinook salmon may encounter numerous stressors during the juvenile rearing and downstream movement, and smolt outmigration lifestages.

Factors limiting salmon populations in the Delta include periodic reversed flows due to high water exports (drawing juveniles into large diversion pumps), loss of fish into unscreened agricultural diversions, predation by introduced species, and reduction in the quality and quantity of rearing habitat due to channelization, pollution, and riprapping (Dettman et al. 1987; California Advisory Committee on Salmon and Steelhead Trout 1988; Kondolf et al. 1996a, 1996b). The suitability of the Delta migration corridor as part of juvenile salmon rearing EFH is reduced by various aspects of CVP/SWP operations (NMFS 2009a). Adverse impacts to EFH may complicate customary habitat functions by extending migration routes (i.e., complex channel configurations make it difficult for salmon to find their way to the ocean), increasing water temperatures, increasing susceptibility to predators, and adding direct mortality from salvage and entrainment operations (NMFS 2009a).

Sacramento River flows, and many juvenile Chinook salmon, enter the Delta Cross Channel (when the gates are open) and Georgiana Slough, and subsequently the central Delta, especially during periods of increased water export pumping from the Delta. Mortality of juvenile salmon entering the central Delta is higher than for those continuing downstream in the Sacramento River. This difference in mortality could be caused by a combination of factors, including (1) the longer migration route through the central Delta to the western Delta; (2) exposure to higher water temperatures; (3) higher predation rates; (4) exposure to seasonal agricultural diversions; (5) water quality impairments due to agricultural and municipal discharges; and (6) a more complex channel configuration that makes it more difficult for salmon to successfully migrate to the western Delta and the ocean (Reclamation 2008).

Estimated fall-run Chinook salmon smolt survival through the Delta was calculated by Kjelson and Brandes (1989) using estimated historic flow patterns under four different Central Valley water development scenarios, by water year type. Their results indicate that reduced inflows into the Delta caused by water development in the Sacramento Valley has reduced fall-run Chinook salmon smolt survival substantially (i.e., about 30 percent from about 1940-1990) (Kjelson and Brandes 1989). According to NMFS (2009), these estimates are considered minimal estimates of survival decline, because greater survival per unit flow would have occurred prior to the operations of the Delta Cross Channel (DCC) in the 1950s. Due to the increased demands in the Central Valley over the intervening 20+ years, Reclamation (2008) suggest that smolt survival is more than likely less under current conditions, compared to when the 1990 level of development estimates were used by Kjelson and Brandes (1989). Additionally, factors affecting salmon populations in Suisun Bay include heavy industrialization within its watershed and discharge of wastewater effluents into the bay. Loss of wetland habitat along the fringes of the bay also has reduced juvenile rearing habitat and diminished the functional processes that wetlands provide for the bay ecosystem (Reclamation 2008).

When juvenile salmon are in the vicinity of the CVP/SWP water export diversion facilities, they are more likely to be drawn into these facilities during water diversion operations. With exports increasing in the future due to CVP/SWP operations, and assuming that entrainment is directly proportional to the amount of water exported, the potential exists for these diversions to adversely affect the ability of outmigrating fall-/late fall-run Chinook salmon to utilize the habitat as they normally would (NMFS 2009).

Overall, NMFS (2009a) state that, based on the available evidence, CVP/SWP system-wide operations are expected to adversely impact Sacramento River fall-/late fall-run Chinook salmon EFH through continuing degradation of spawning and rearing habitat, water temperature-related impacts, reduced flows, and entrainment at unscreened water diversions. According to NMFS (2009a), increased level of water demands through 2030, reduced diversions from the Trinity River, and future climate change are anticipated to exacerbate water temperature-related impacts to EFH. However, many actions within the RPA described in NMFS (2009) will generally improve EFH for naturally spawning fall- and late-fall run Chinook salmon by improving adult fish passage at RBDD, increasing juvenile survival (i.e., reducing predation, and entrainment at diversions), reducing water temperature related impacts, increasing reservoir storage, and restoring EFH in tributary spawning areas (NMFS 2009a).

In developing its EFH conservation recommendations for CVP/SWP system-wide operations, NMFS (2009a) recognized that the appropriate and practicable steps to avoid adverse effects to EFH and measures to minimize remaining adverse affects are constrained due to the existing

CVP/SWP operational conditions that have transpired over the time span in which water in the Central Valley has been managed. Consequently, available opportunities to avoid and minimize adverse effects may be limited. In addition, NMFS (2009a) states that its highest priority is to fulfill its conservation mandates for protecting winter- and spring-run Chinook salmon and steelhead listed under the ESA, and in some instances, this priority may take precedent over protecting the EFH of fall and late-fall run Chinook salmon for particular locations. Due to these limitations to avoid and minimize EFH impacts, NMFS (2009a) believes that available conservation measures may be insufficient to offset the expected further deterioration of EFH habitat functions in parts of the CVP/SWP project area. Generally, however, actions to protect listed anadromous fish species will provide benefits to non-listed salmonids (e.g., fall- and late fall-run Chinook salmon) because they share similar habitats and respond to environmental impacts in a comparable fashion (NMFS 2009a).

6.2.3 Yuba River Chinook Salmon

The Yuba River spring-run Chinook salmon population is exposed and subject to the myriad limiting factors, threats and stressors described for the Central Valley ESU in Chapter 5 of the Applicant-Prepared Draft BA. Although no recovery plan has been developed for the fall-/late fall-run Chinook salmon ESU because the ESU is not listed under the ESA, many of the key threats and stressors identified for spring-run Chinook salmon and steelhead in the NMFS Draft Recovery Plan (NMFS 2009) and those described in Chapter 5 of the Applicant-Prepared Draft BA also generally are applicable to fall-run Chinook salmon and EFH.

The previous discussions in this Applicant-Prepared Draft EFH assessment addressing Central Valley fall/late-fall run Chinook salmon general life history and habitat requirements that also pertain to spring-run Chinook salmon are not repeated in this section of the Applicant-Prepared Draft EFH assessment. Additionally, general life history and habitat requirements, population status and trends, limiting factors, threats and stressors to spring-run Chinook salmon are fully described in the Applicant-Prepared Draft BA, and are not repeated here.

6.3 Overview of Chinook Salmon EFH Components in the Action Area

As the first step of an EFH assessment, NMFS (2009c) states that the existing habitat condition at time of consultation must be evaluated, and used as a point of reference for subsequent analyses. NMFS (2004a) also states that "*The adverse effects discussed in the BA can be referenced, and additional effects discussed… Unless it is clear that the effects to an individual species are unique, it is not necessary to discuss the adverse effects on a species-by-species basis. .. Instead, discuss the project's effects on EFH, generally*." In consideration of the above, the text below provides a description of the existing condition of EFH in the Action Area.

As part of an EFH Assessment, NMFS (2004a) states that federal action agencies should indicate whether a proposed action may adversely affect HAPCs. As previously discussed, NMFS and PFMC (2011) developed five potential HAPCs for Pacific Coast salmon as part of the 2011 5-year review. Two of the five HAPCs occur in estuarine and marine environments and, thus, while these two HAPCs are important to the fall-/late fall-run Chinook salmon ESU, they are not found within the EFH Action Area for the Proposed Action. The other three potential HAPCs include: (1) spawning habitat; (2) thermal refugia; and (3) complex channels and floodplain habitats. These three HAPCs are included in the evaluation, below, of EFH in the Action Area. They are evaluated as subcomponents of the organizational components of migratory habitat (adult upstream and juvenile downstream), spawning and embryo incubation habitat, and juvenile rearing habitat. The EFH assessment was organized according to these components because they correspond to the primary constituent elements (PCEs) of designated critical habitat for Central Valley spring-run Chinook salmon ESU (i.e., freshwater migration corridors, freshwater spawning sites, and freshwater rearing sites) that have the potential to be affected by the Proposed Action.

Characterization of the existing condition of EFH is presented for two primary geographical areas: (1) Yuba River Watershed Upstream of Englebright Dam; and (2) the lower Yuba River downstream of Englebright Dam.

6.3.1 Yuba River Watershed Upstream of Englebright Dam

Although EFH in the Yuba River Watershed is designated both upstream and downstream of the Corps' Englebright Dam, Chinook salmon presently utilize the lower Yuba River for migration, spawning and embryo incubation, juvenile rearing and downstream movement. Currently, Chinook salmon are prevented from accessing EFH located in the upper Yuba River Watershed due to the presence of the Corps' Englebright Dam. For completeness in characterizing EFH components in the Action Area, available information from several recently conducted FERC relicensing studies in the upper Yuba River Watershed was used to generally describe the potential suitability of aquatic habitat conditions for Chinook salmon upstream of Englebright Dam.

6.3.2 Yuba River Downstream of Englebright Dam

Because Chinook salmon occupy the lower Yuba River downstream of Englebright Dam, a large amount of information has been developed regarding the manner in which numerous stressors affect habitat, including EFH, in the lower Yuba River. Characterization of the existing condition of EFH in the lower Yuba River follows the same organizational structure of migratory habitat, spawning and embryo incubation habitat, and juvenile rearing habitat, incorporating evaluation and consideration of HAPCs. Within that organizational structure, additional information is presented for habitat-related stressors for Chinook salmon in the lower Yuba River.

According to NMFS (2009b), the key limiting factors, threats and stressors affecting Chinook salmon in the lower Yuba River include the following.

- Passage Impediments/Barriers
- Physical Habitat Alteration
- Entrainment
- Loss of Floodplain Habitat
- Harvest/Angling Impacts
- Predation
- Poaching
- Loss of Natural River Morphology and Function

Loss of Riparian Habitat and Instream Cover (riparian vegetation, instream woody material)	Hatchery Effects (FRFH genetic considerations, straying into the lower Yuba River, lower Yuba River genetic considerations)

This EFH assessment addresses only habitat-related stressors that potentially could be affected by the Proposed Action. Therefore, the stressors identified by NMFS (2009) of entrainment, harvest/angling impacts, poaching, and hatchery effects, are not evaluated in this Applicant-Prepared Draft EFH assessment. Available information regarding the effects of these stressors on Chinook salmon, and spring-run Chinook salmon in particular, is provided in Chapter 5 of the Applicant-Prepared Draft BA. The existing characterization (i.e., conditions under the Environmental Baseline) of habitat-related stressors in the lower Yuba River, including passage impediments/barriers, predation, and physical habitat alteration (including natural river morphology, floodplain habitat and riparian habitat and instream cover), in addition to other key considerations regarding Chinook salmon EFH (including spawning habitat availability, potential effects of Narrows 2 operations on adult migration, fry and juvenile stranding, and water temperature suitabilities), are described below for Chinook salmon (and specifically for spring-run and fall-run Chinook salmon where applicable) lifestages.

6.4 Migratory Habitat (Adult Upstream and Juvenile Downstream)

Freshwater migration corridors provide upstream passage for adults to upstream spawning areas, and downstream passage of outmigrant juveniles to estuarine and marine areas. Migratory corridors are downstream of the spawning areas and include the lower reaches of the spawning tributaries.

Excluding the lower river reaches that were used as adult migration corridors (and, to a lesser degree, for juvenile rearing), it has been estimated that at least 72 percent of the original Chinook salmon spawning and holding habitat in the Central Valley drainage is no longer available due to the construction of non-passable dams (Yoshiyama et al. 2001). Adult migrations to the upper reaches of the Sacramento, Feather, and Yuba rivers were eliminated with the construction of major dams during the 1940s, 1950s and 1960s. After growth and maturation, whether in freshwater or the ocean, adult salmon generally return to their natal spawning areas for reproduction, though some straying into other basins is natural. As described in ISG (1996), the timing of adult entry and movement in rivers and tributary streams, and even the size, shape, and strength of adult fish represent adaptations to the physical and biological challenges presented by the upstream route to a specific spawning area.

Generally, adequate flow is an important component of adult upstream migration habitat because it can serve as an immigration cue and provide adequate depths for passage at critical locations (e.g., shallow riffles). Additionally, flow can provide outmigration cues for emigrating juveniles or smolts. Available cover is not necessarily an important migration corridor habitat component for adult immigrants, but serves as predator and thermal refugia for outmigrating juveniles.

Migratory habitat conditions in the Central Valley are strongly affected by the presence of barriers, which can include dams (i.e., hydropower, flood control, and irrigation flashboard dams), unscreened or poorly screened diversions, degraded water quality, or behavioral impediments to migration (Reclamation 2008). For example, physical barriers may be passable only at the range of flows that typically occurs during one month of the year, and then only by fish that have the physical ability to jump over or otherwise ascend the barrier (NMFS 2008). For fall-spawning Chinook salmon in the Central Valley, warm water conditions in late summer often present thermal barriers to movement and there may be little suitable habitat for resting (Berman and Quinn 1991, cited in ISG 1996). Thermal refugia include habitat areas where fish may escape high water temperatures, especially during hot, dry summers in California. Thermal refugia have been identified as an HAPC that provides important holding habitat for adult Chinook salmon (Goniea et al. 2006; Sutton et al. 2007 in NMFS 2010a).

6.4.1 Yuba River Watershed Upstream of Englebright Dam

6.4.1.1 North Yuba River (New Bullards Bar Dam Reach)

6.4.1.1.1 Flow-Related Instream Habitat

Adequate flow is an important component of adult Chinook salmon upstream migration habitat because it can serve as an immigration cue and provide adequate depths for passage at critical locations (e.g., shallow riffles). Additionally, flow can provide outmigration cues for emigrating juveniles or smolts. Although not conducted specifically for Chinook salmon EFH, information presented in *Technical Memorandum 3-10 - Instream Flow Upstream of Englebright Reservoir* may be used to provide an indication of flow-related physical instream habitat conditions upstream of Englebright Reservoir, as discussed below.

While the channel of the North Yuba River (New Bullards Bar Dam Reach) is dominated by gradients below 3 percent (average gradient of 2%), there is one short section where the gradient is greater than 3 percent and one short section that is above 5 percent. Just above the 5 percent section, the gradient flattens to less than 1 percent. The geology is composed of Mesozoic volcanic rocks of the Smartsville Complex. Most of the reach is composed of bedrock and car and house-sized boulders that separate large mid-channel pools. There are very short and infrequent areas of cobble-size deposits, but most of the substrate is large and immobile. There is no apparent floodplain or terrace development.

This 2.3-mile reach is largely inaccessible. Two areas were ground-mapped: North Yuba upstream of the Middle Yuba River junction and just downstream of New Bullards Bar Dam; the remainder was mapped using the aerial video. This is a very rugged stream with large boulders that often cover the channel, and large, deep pools bounded by bedrock. The middle steeper section cannot be safely accessed by foot from upstream due to a deep bedrock gorge with vertical cliff walls blocking the way. The lower section is a rugged path through very large boulders that cover pocket water and separate deep pools.

Aquatic habitat is dominated by pocketwater and mid-channel pools (Table 6.4.1-1). Identified cover is exclusively boulders, but the depth of pools can also provide cover to resident trout. A summary of ground-mapped date for the New Bullards Bar Reach of the North Yuba River is presented in Table 6.4.1-2. Trout spawning-sized gravel accumulations were rare (511 sq ft), as was LWM (one log in the diameter class 12-24 inches, length class 25-50 ft, within the wetted channel), and potential natural barriers to resident trout upstream movement likely are very common in the confined, steep channel. Bank erosion was rare, given the bedrock/boulder channel margins.

Table 6.4.1-1. Length, frequency, width and depth of ground-mapped habitat units for the North Yuba River – New Bullard Bar Reach (between the junction with the Middle Yuba River and New Bullards Bar Dam). The shaded cells are characteristics of pools that do not apply to non-pool habitat types (Source: Technical Memorandum 3-10).

Unit Type	Total Length (ft)	Length Relative Frequency	Number	Number of Units (frequency)	Average width (ft)	Average pool depth (ft)	Average maximum pool depth (ft)	Average pooltail embeddedness (%)
Fall	63	1.1%	3	8.8%	66.0			
Cascade	22	.04%	1	2.9%	55.0			
Chute	--	--	--	--	--			
Rapid	778	13.1%	2	5.9%	81.5			
High Gradient Riffle	455	7.7%	3	8.8%	66.2			
Low Gradient Riffle	399	6.7%	3	8.8%	59.8			
Glide	--	--	--	--	--			
Run	--	--	--	--	--			
Step Run	639	10.8%	3	8.8%	76.1			
Pocket Water	687	11.6%	5	14.7%	49.3			
Sheet	--	--	--	--	--			
Convergence Pool	--	--	--	--	--	--	--	--
Mid-Channel Pool	2,894	48.7%	14	41.2%	72.7	3.8	7.3	--
Lateral Scour Pool	--	--	--	--	--	--	--	--
Trench Pool	--	--	--	--	--	--	--	--
Plunge Pool	--	--	--	--	--	--	--	--
Total	**5,937**	**100.0%**	**34**	**100.0%**	**70.0**	**3.8**	**7.7**	**--**

Table 6.4.1-2. Summary of ground mapped data for the North Yuba River – New Bullard Bar Reach (between the junction with the Middle Yuba River and New Bullards Bar Dam).

Total Reach Length	2.3 miles
Total Ground Mapped Length	1.12 miles (49.0%)
Average Bankfull Width	70 feet
Average Bankfull Depth	3.5 feet
Average Width:Depth	20
Total Spawnable Gravel	511 $feet^2$ - trout

Table 6.4.1-2. (continued)

Average Largest Patch Size	31 feet^2 - trout
LWD Density	1 / mile (within bankfull width)
Wetted LWD Density	1 / mile (within wetted width)
Parent Material	Mesozoic rocks of the Smartville Complex
Bank Erosion % of Reach	0.0%
Total No. Passage Barriers	4

6.4.1.1.2 Thermal Refugia (Water Temperatures)

Water temperature is an important habitat component of migration corridors, and water temperature changes may result in a gradation of potential effects on migrating adults and emigrating juveniles. As described in *Technical Memorandum 2-5 - Water Temperature Monitoring*, YCWA monitored water temperature at 38 sites potentially affected by the Proposed Action from 2008 through 2012, including three sites on the North Yuba River. Mean daily water temperatures monitored in EFH reaches of the North Yuba River potentially affected by the Proposed Action (i.e., below New Bullards Bar Dam (RM 2.3) and above the confluence with the Middle Yuba River (RM 0.1)) during Water Years 2009 through 2012 are presented in Table 6.4.1-3.

In general, water temperatures below New Bullards Bar Dam were cooler than those above the North Yuba River confluence. During the winter, the temperature difference was usually only a few degrees. From May to October, the difference was between 3°C and 12°C, with the greatest difference in June and July. Mean daily water temperatures below project facilities in the North Yuba River were less than 68°F (20°C) except for approximately 23 percent of the days from June through October above New Bullards Bar Reservoir and 50 percent of the days from June through October near the confluence with the Middle Yuba River. The maximum mean daily water temperature recorded in the North Yuba River was 75.0°F (23.9°C) during July 2010.

During August 2009, there was a sharp decrease in water temperatures in the North Yuba River above the Middle Yuba River, which was caused when the low-level outlet at New Bullards Bar Dam increased releases to over 1,000 cfs due to an outage downstream at New Colgate Powerhouse. The outage was related to a forest fire that burned in the vicinity of the powerhouse and associated structures.

To compare water temperatures below New Bullards Bar Dam and above the confluence with the Middle Yuba, Figure 6.4.1-1 shows mean daily temperatures in the North Yuba River at RMs 0.1 and 16.0 for Water Years 2009, 2010, 2011 and 2012. In general, water temperature trends near the Middle Yuba River confluence were similar to those seen above New Bullards Bar Reservoir in an unregulated stream reach. Water temperatures tended to be the highest during the spring when upstream runoff flows were being captured by the reservoir. Once the runoff period ended, water temperatures were very similar through the summer. The sharp decrease in water temperatures during August was caused when the low-level outlet at New Bullards Bar Dam increased releases to over 1,000 cfs due to an outage downstream at New Colgate Powerhouse, which was caused by a forest fire that burned in the vicinity of the powerhouse and associated structures.

Table 6.4.1-3. Summary of minimum and maximum daily average water temperatures (°C) by month within EFH reaches in the Upper Yuba River Watershed potentially affected by the Proposed Action during Water Years 2009 through 2012. Shaded cells indicate values over 20°C (68°F).

Location	River Mile	Water Year	October		November		December		January		February		March		April		May		June		July		August		September	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
NORTH YUBA RIVER																										
NYR at Low Flow Releases from New Bullards Bar Dam	NYR 2.3	2009	8.0	8.9	8.7	9.5	8.6	9.6	8.4	9.1	7.8	8.8	7.5	8.4	7.6	9.2	8.0	10.0	8.8	10.1	9.6	10.1	No Data	No Data	No Data	No Data
		2010	7.7	8.9	7.4	8.0	6.5	7.6	7.4	7.9	7.6	8.1	7.7	8.8	7.7	9.4	8.7	9.6	9.4	10.6	10.3	10.9	10.0	10.7	9.5	10.3
		2011	8.7	9.9	7.6	8.9	7.7	9.3	7.5	8.1	7.0	8.0	7.4	8.4	7.4	8.5	7.4	8.6	7.6	9.1	8.9	9.8	9.4	9.7	8.7	9.5
		2012	7.8	8.8	7.2	7.8	6.7	7.3	6.7	7.6	7.1	7.9	7.2	8.8	7.3	9.4	8.6	9.8	9.0	10.4	9.9	10.5	9.7	10.5	9.2	9.9
NYR upstream of Middle Yuba River	NYR 0.0	2009	8.1	13.6	8.7	9.6	9.1	9.6	No Data	No Data	No Data	No Data	10.7	11.7	10.4	16.0	10.3	20.7	17.2	22.5	20.2	23.8	8.3	23.5	15.1	19.8
		2010	7.4	14.0	7.8	9.3	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	8.1	14.1	11.2	16.1	13.8	22.3	20.7	23.9	18.0	22.5	15.9	19.5
		2011	10.3	17.2	10.1	11.8	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	19.7	22.5	20.2	22.5	17.1	20.0
		2012	10.0	17.1	8.2	10.2	2.2	5.6	2.9	7.3	5.0	8.1	6.3	10.6	8.4	14.8	11.7	18.3	16.2	21.3	20.2	22.0	18.6	22.4	16.4	19.3
MIDDLE YUBA RIVER																										
MYR downstream of Our House Diversion Dam	MYR 12.6	2009	10.2	11.0	6.3	11.4	1.0	6.4	2.2	6.7	2.4	6.4	4.8	8.8	6.8	11.6	8.0	16.6	14.0	21.9	20.2	24.6	20.1	24.3	15.8	21.2
		2010	8.3	14.9	3.9	10.2	0.7	5.6	3.7	7.0	5.1	7.2	4.8	8.6	5.2	9.6	6.9	10.6	9.5	18.8	17.5	23.3	17.6	21.9	16.0	19.8
		2011	8.3	17.4	2.9	10.7	3.7	7.2	2.9	6.5	1.2	6.1	3.5	7.5	5.0	9.0	5.6	9.8	7.6	13.5	13.7	21.5	19.4	21.6	16.8	19.8
		2012	9.1	16.8	5.0	9.1	0.5	4.5	0.6	5.5	2.9	6.3	2.4	8.1	4.9	10.5	9.0	16.7	13.5	20.7	20.6	23.2	20.3	24.2	17.6	20.8
MYR upstream of North Yuba River	MYR 0.0	2009	9.1	18.0	6.4	12.6	1.4	6.7	No Data	No Data	No Data	No Data	10.4	11.8	9.7	16.9	9.2	21.6	17.6	24.4	21.5	25.9	20.5	25.5	15.2	21.5
		2010	8.1	15.2	8.5	11.3	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	6.8	13.5	10.2	15.6	13.8	23.9	21.7	26.0	18.7	23.3	16.3	20.7
		2011	9.3	18.3	3.5	11.6	3.9	8.7	3.7	7.5	2.9	6.8	4.5	10.4	6.4	12.8	6.6	14.2	10.0	17.7	17.3	24.1	20.9	24.0	17.6	20.9
		2012	9.6	17.6	7.5	9.9	0.3	5.1	0.6	6.6	3.5	7.5	4.9	10.3	7.5	14.6	11.9	19.3	16.7	23.2	21.7	24.4	20.0	25.1	17.3	21.1
YUBA RIVER UPSTREAM OF ENGLEBRIGHT RESERVOIR																										
Yuba River downstream of Confluence of North Yuba River and Middle Yuba River	YR 40.0	2009	8.6	15.1	8.0	11.4	4.8	8.3	No Data	No Data	No Data	No Data	10.5	11.8	9.9	16.9	9.4	21.5	17.5	23.9	21.2	25.4	11.5	25.0	15.5	21.0
		2010	9.2	14.3	8.6	10.2	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	6.9	13.6	10.3	15.7	13.9	23.5	21.5	25.4	18.6	22.8	16.3	20.4
		2011	9.6	18.1	9.6	11.8	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	20.1	23.7	20.7	23.6	17.6	20.8
		2012	9.7	17.6	7.5	10.0	No Data	No Data	No Data	No Data	No Data	No Data	5.9	10.3	7.7	14.7	12.0	18.6	16.7	23.0	21.8	24.1	20.1	24.4	17.5	20.9
Yuba River upstream of New Colgate Powerhouse	YR 34.4	2009	8.4	18.2	9.1	10.8	7.8	9.6	No Data	No Data	No Data	No Data	11.8	12.8	11.2	18.1	10.0	22.7	18.9	24.5	21.6	25.9	9.6	25.7	17.0	21.8
		2010	8.0	16.0	8.9	10.7	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	7.8	14.6	11.8	16.9	14.8	24.6	22.5	26.4	19.8	23.9	17.6	21.5
		2011	10.9	19.2	4.7	13.0	4.7	10.5	4.6	8.3	4.9	7.8	5.9	11.4	8.2	13.3	9.9	12.7	11.3	14.8	14.3	24.9	20.8	24.9	18.9	22.0
		2012	11.0	19.0	5.9	11.2	0.4	5.2	1.0	6.3	4.0	7.5	5.1	10.3	7.5	15.3	12.2	19.8	17.5	22.6	21.3	23.5	19.6	24.2	17.5	20.8
Yuba River downstream of New Colgate Powerhouse	YR 34.1	2009	8.4	13.7	9.0	10.8	7.8	9.6	No Data	No Data	No Data	No Data	7.5	9.8	7.1	9.3	7.7	8.6	7.3	8.1	7.6	7.9	7.9	11.7	8.4	12.0
		2010	8.7	9.1	9.0	9.0	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	7.9	8.4	7.9	8.2	8.2	8.5	8.5	8.8	8.8	9.4	10.0	16.5
		2011	9.5	14.5	8.1	10.6	8.1	9.8	7.8	8.4	7.3	7.8	6.7	7.4	6.7	7.1	6.9	7.4	7.2	7.6	7.5	7.8	7.8	9.1	8.6	11.7
		2012	8.7	11.1	8.8	9.2	7.4	9.1	8.2	9.2	8.0	8.6	7.4	8.6	7.4	8.1	7.6	9.7	8.3	11.4	8.1	10.5	8.7	10.7	9.6	14.0
Yuba River downstream of Dobbins Creek	YR 33.9	2009	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	8.0	8.7	7.7	8.5	8.0	10.7	7.8	9.2	8.0	8.4	8.3	11.9	8.8	11.3
		2010	8.8	10.1	9.0	10.3	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	8.1	9.5	8.3	9.9	8.5	9.2	8.7	9.1	9.1	9.8	9.9	14.1
		2011	9.7	13.4	10.1	11.1	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	6.8	9.0	7.6	9.4	7.6	10.5	7.8	9.4	8.1	9.6	9.4	11.4
		2012	8.9	12.6	8.9	13.0	7.7	9.0	7.8	8.8	7.5	8.6	7.4	9.2	7.6	9.7	7.9	9.4	8.3	10.4	8.4	10.2	8.9	10.3	9.7	10.9

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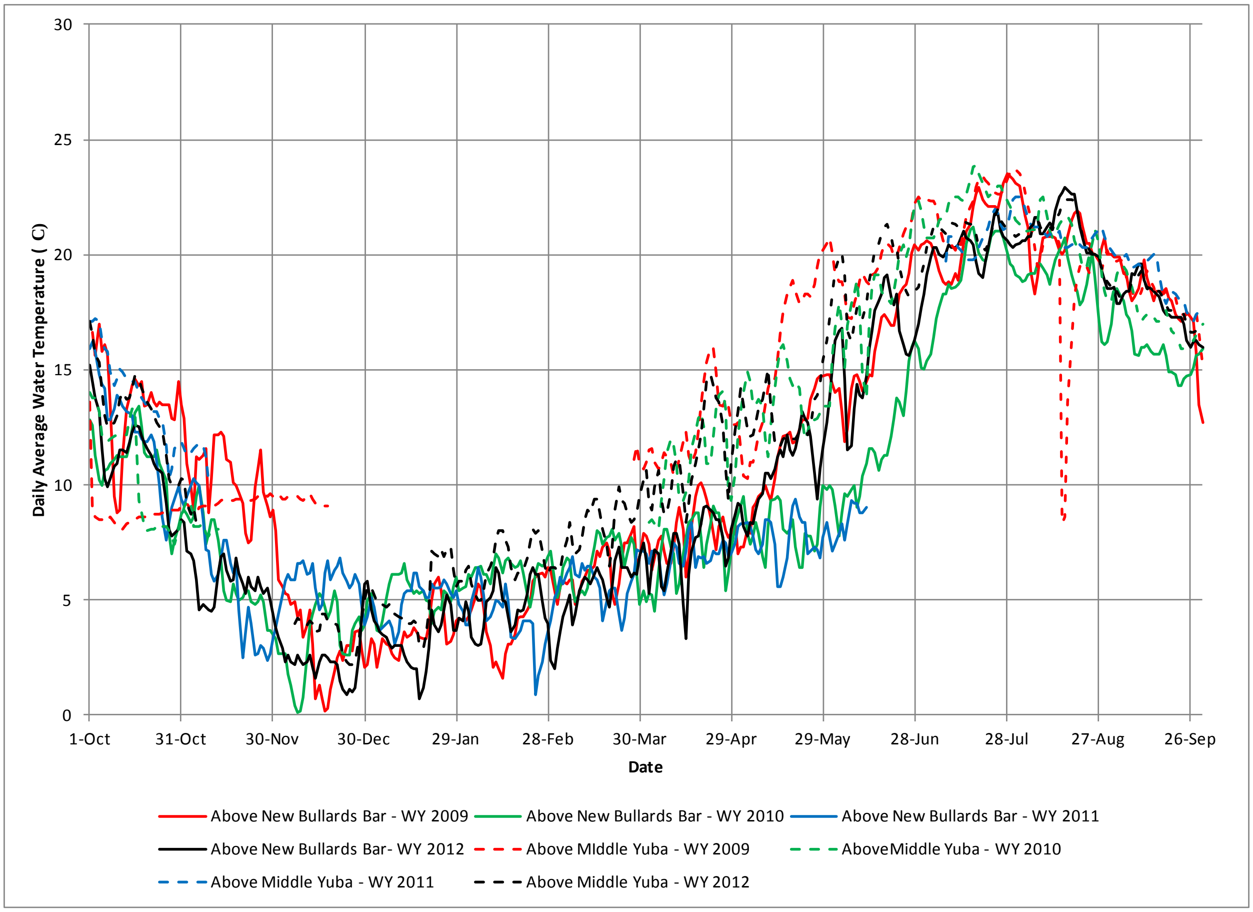

Figure 6.4.1-1. Mean daily water temperatures in the North Yuba River above New Bullards Bar Dam (RM 16.1) and above the Middle Yuba River confluence (RM 0.1) in Water Years 2009, 2010, 2011 and 2012.

Water temperatures in the North Yuba River generally increased during May or June through August and early September, before declining in late September and October – a temperature trend that is consistent with the Mediterranean climate patterns of inland northern California. On a daily scale, monitoring locations showed a widely varying amount of diurnal influence as seen in the plots found in YCWA *Technical Memorandum 2-5, Water Temperature Monitoring*, Attachment 2-5. Diurnal variance was increasingly evident in locations with lower flows and/or increasing distance from low-level reservoir outlets. In addition, the trends in the water temperature data tended to closely follow trends seen in mean daily air temperatures observed regionally; this trend was also stronger at those locations with lower flows or increased distance from reservoir outlets as water temperatures began to approach equilibrium with the surrounding environment.

Monitoring results during the July through December fall-run Chinook salmon adult immigration and staging period indicated that, if fish were able to access areas upstream of Englebright Dam, maximum daily average water temperatures in the North Yuba River upstream of the Middle Yuba River met or exceeded the upper tolerance WTI of 68°F (20°C) during July and August of all years (2009 through 2012) and during September 2011. During the December through June fall-run Chinook salmon juvenile rearing and downstream movement period, maximum daily average water temperatures in the North Yuba River upstream of the confluence with the Middle Yuba River met or exceeded the upper tolerance WTI of 65°F (18.3°C) during May 2009 and 2012, and during June 2009, 2010 and 2012.

Similarly, monitoring results indicate that during the April through September spring-run Chinook salmon adult immigration and holding period, maximum daily average water temperatures in the North Yuba River upstream of the confluence with the Middle Yuba River exceeded the upper tolerance WTI of 68°F during May 2009, June 2009, July and August 2009 through 2012, and September 2011. During the year-round spring-run Chinook salmon juvenile rearing and downstream movement period suggest that, if fish were able to access areas upstream of Englebright Dam, maximum daily average water temperatures in the North Yuba River upstream of the Middle Yuba River met or exceeded the upper tolerance WTI of 65°F during May 2009 and 2012, June 2009, 2010 and 2012, and during all sampled years in July, August and September. Additionally, minimum daily average water temperatures in the North Yuba River upstream of the Middle Yuba River during July, August and September usually exceeded 65°F.

6.4.1.1.3 Habitat Access - Physical Barriers

Although not conducted specifically for Chinook salmon EFH, a channel morphology study in the river reaches upstream of Englebright Reservoir that are potentially affected by the Proposed Action was undertaken by YCWA during 2011 and 2012. The study focused on channel morphology, riparian vegetation and sediment mobility (YCWA 2013). As discussed below, information from the channel morphology study provide an indication of North Yuba River channel conditions and physical barriers in areas of EFH that could be potentially affected by the Proposed Action upstream of Englebright Reservoir.

- Project-affected reaches in the North Yuba River are mostly transport reaches, with few response reaches where depositional processes dominate within or adjacent to the channel. In the North Yuba River, there is significant bedrock control and the mainstem channel often travels through bedrock gorges.
- The channel is characterized by large substrate, steep gradients, vertical confinement, low bank erodibility, and low fine sediment accumulation.
- The North Yuba River exhibited gradients >1 percent and were composed of coarse and generally resistant bed and bank material. Gradients generally were between 1 and 2.9 percent, except for the site on the mainstem Yuba River below the New Colgate Powerhouse. The North Yuba River site was the steepest at almost 3 percent.
- Bedrock/boulder controls were the greatest in the North Yuba River (66%). Because of the amount of bedrock and boulder control, channel stability was determined to be good, and bank erosion hazard was determined to be low to very low.

As described in Technical Memorandum 3-10, four passage barriers (i.e., significant waterfalls, high velocity chutes, weirs or other man-made obstacles, or features with a vertical drop exceeding 2.5 feet) were identified in the North Yuba River.

6.4.1.2 Middle Yuba River (with Emphasis on the ~1.5 Miles of EFH Upstream from the Confluence of the Middle Yuba River and the North Yuba River)

6.4.1.2.1 Flow-Related Instream Habitat

Based on studies conducted for *Technical Memorandum 3-10 - Instream Flow Upstream of Englebright Reservoir*, the 12-mile reach surveyed in the Middle Yuba River flows through a variety of parent materials, most notably resistant granitic rocks, and is bisected by the Big Bend-Wolf Creek fault within 1 mile of the junction with the North Yuba River. The overall gradient is 1.2 percent, with one break at the Big Bend/Wolf Fault (2.5 percent below the fault, and 1.1 percent above). There are numerous lower gradient sections, many of which are upstream of sharp bends that form “knickpoints”24. However, in any of these lower gradient sections where it appears that there is floodplain and side-channel development, sinuosity never exceeds 1.1 (i.e., valley length and channel length through the valley are approximately equal). There is a hydrologic break at Oregon Creek, separating the reach into Our House Diversion Dam Reach (Middle Yuba River upstream of Oregon Creek) and the Oregon Creek Reach (Middle Yuba River downstream of Oregon Creek). This is a confined channel, with extensive sections of bedrock forming the channel; specifically, RM 9-10.2, and RM 11.4-11.7 where the channel is almost exclusively bedrock. Trench pools are indicative of the bedrock-dominated sections, though shallow, mid-channel pools also form in the bedrock sections. Cobble or boulder bars and resistant bedrock and boulder banks resist lateral and vertical movement of the channel.

Heavy recreation, rural housing, and mining have modified the channel and riparian zone in the area of Freemans Crossing. Through this low gradient (about 1%) section, the channel is very wide and shallow, and has substantial amounts of finer material (e.g., gravel in the channel and sand on the banks). A multi-thread channel splits around an area known as “Emory Island” (~RM 6.5), though sinuosity is still fairly low at 1.1, and map-based gradient is about 1 percent. The habitat was mapped within the main channel, but it is a split channel and at high flow, about 30 percent of the flow will divert to the right channel (ascending).

Ground-based habitat mapping was performed at four locations within the Middle Yuba Reach: at the junction with the North Yuba (RM 0); above and below the Oregon Creek (RM 4.5); and below Our House Diversion Dam (RM 12.2). Table 6.4.1-4 summarizes the habitat frequency for the reach. The habitat frequency is based on the total number of “hits” on a habitat using the aerial video method, with the ground-based data (16 percent of the reach) used to interpret the habitat. Habitat is dominated by mid-channel pools, low gradient riffles, and runs; additional habitat types that exceed 5 percent include high gradient riffles, lateral pools and trench pools.

[24] A knickpoint is a term used to describe a location in a river or channel where there is a sharp change, resulting from differential rates of erosion above and below the knickpoint.

Instream cover is limited to boulders. Table 6.4.1-5 also summarizes the data for physical parameters measured in the field. There is over 2,000 square feet of trout spawning-sized gravel accumulations within the mapped sections. There was very limited large woody debris identified during ground-based assessments. The ground-based data collected in the Middle Yuba River indicate there are spawning-sized gravel accumulations. Upstream trout migration may by limited by permanent falls or other barriers, large woody debris is an uncommon element, and does not modify channel form or fish habitat in the active channel.

Table 6.4.1-4. Length, frequency, width and depth of ground-mapped habitat units in the Middle Yuba River – Oregon Creek and Our House Diversion Dam Reaches (between the junction with North Yuba River to Our House Diversion Dam). The shaded cells are characteristics of pools that do not apply to non-pool habitat types.

Unit Type	Total Length (ft)	Length Relative Frequency	Number	Number of Units (frequency)	Averag e width (ft)	Average pool depth (ft)	Average maximum pool depth (ft)	Average pooltail embeddedness (%)
Fall	--	--	--	--	--			
Cascade	421	2.7%	7	6.4%	63.4			
Chute	47	0.3%	1	0.9%	22.3			
Rapid	70	0.5%	1	0.9%	26.5			
High Gradient Riffle	1,014	6.5%	9	8.2%	53.1			
Low Gradient Riffle	1,998	12.9%	17	15.5%	62.0			
Glide	531	3.4%	2	1.8%	53.8			
Run	2,269	14.6%	23	20.9%	52.9			
Step Run	1,225	7.9%	8	7.3%	69.2			
Pocket Water	654	4.2%	5	4.5%	55.5			
Sheet	--	--	--	--	--			
Convergence Pool	--	--	--	--	--	--	--	--
Mid-Channel Pool	6,183	39.8%	20	27.3%	56.8	3.7	6.9	7.9
Lateral Scour Pool	469	3.0%	2	1.8%	101.9	1.8	3.5	25.0
Trench Pool	216	1.4%	1	0.9%	75.3	4.0	8.0	--
Plunge Pool	446	2.9%	4	3.6%	53.3	5.8	7.0	5.0
Total	**15,542**	**100.0%**	**110**	**100.0%**	**58.9**	**3.8**	**6.3**	**12.6**

Table 6.4.1-5. Reach summary of ground mapped data for the Middle Yuba River – Oregon Creek and Our House Diversion Dam Reaches (between the junction with North Yuba River to Our House Diversion Dam).

Total Reach Length	12.2 miles
Total Ground Mapped Length	2.94 miles (16.0%)
Average Bankfull Width	58.9 feet
Average Bankfull Depth	2.5 feet
Average Width:Depth	24
Total Spawnable Gravel	2,311 feet^2 - trout
Average Largest Patch Size	44 feet^2 - trout
LWD Density	5 / mile (within bankfull width)
Wetted LWD Density	4 / mile (within wetted width)
Parent Material	Volcanic, granite/granodiorite, metasedimentary
Bank Erosion % of Reach	0.0%
Total No. Passage Barriers	2

6.4.1.2.2 Thermal Refugia (Water Temperatures)

Mean daily water temperatures monitored in EFH reaches of the Middle Yuba River potentially affected by the Proposed Action (i.e., from Our House Diversion Dam (RM 12.7) to the confluence with the North Yuba River (RM 0.1)) during Water Years 2009 through 2012 are presented in Figure 6.4.1-2.

In general, water temperatures below Our House Diversion Dam in the Middle Yuba River were cooler than those above the North Yuba River confluence. Mean daily water temperatures below Project facilities in the Middle Yuba River were less than 68°F (20°C) except for approximately 46 percent of the days from June through September near Our House Diversion Dam and 64 percent of the days from June through September near the confluence with the North Yuba River. The maximum mean daily water temperature recorded in the Middle Yuba River was 78.8°F (26.0°C) during July 2010.

In Oregon Creek, approximately 20 percent of the days from June through September below Log Cabin Diversion Dam and 4 percent of the days from June through September near the Middle Yuba River confluence. The maximum mean daily water temperature recorded in Oregon Creek was 73.4°F (23°C) during July 2010.

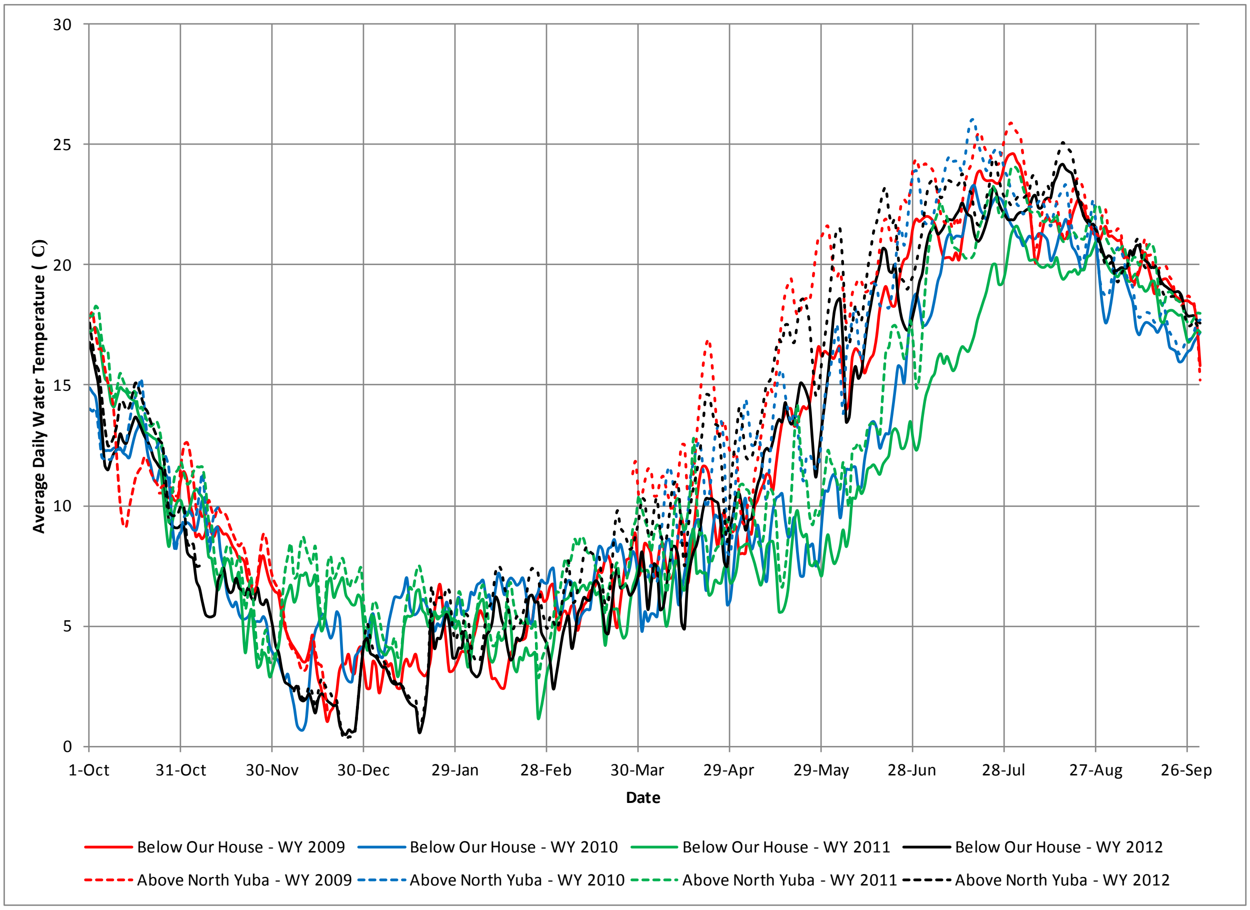

Figure 6.4.1-2. Mean daily water temperatures in the Middle Yuba River from Our House Diversion Dam (RM 12.7) to the North Yuba River confluence (RM 0.1) during Water Years 2009, 2010, 2011 and 2012.

Monitoring results during the July through December fall-run Chinook salmon adult immigration and staging period indicated that, if fish were able to access areas upstream of Englebright Dam, maximum daily average water temperatures in the Middle Yuba River upstream of its confluence with the North Yuba River met or exceeded the upper tolerance WTI of 68°F (20°C) during July and August of all years (2009 through 2012) and during September 2011. During the December through June fall-run Chinook salmon juvenile rearing and downstream movement period (assuming that fish were able to access areas upstream of Englebright Dam), maximum daily average water temperatures in the Middle Yuba River upstream of the confluence with the North Yuba River exceeded the upper tolerance WTI of 65°F (18.3°C) during May 2009 and 2012, and during June 2009, 2010 and 2012.

Similarly, monitoring results indicate that during the April through September spring-run Chinook salmon adult immigration and holding period, maximum daily average water temperatures in the Middle Yuba River upstream of the confluence with the North Yuba River exceeded the upper tolerance WTI of 68°F during May 2009, June 2009, 2010, and 2012, and July through September 2009, 2010, 2011 and 2012. During the year-round spring-run Chinook salmon juvenile rearing and downstream movement period, maximum daily average water temperatures in the Middle Yuba River upstream of the confluence with the North Yuba River met or exceeded the upper tolerance WTI of 65°F during May 2009 and 2012, June 2009, 2010 and 2012, during July, August and September in all sampled years, and October 2011. Additionally, minimum daily average water temperatures in the Middle Yuba River upstream of the confluence with the North Yuba River generally exceeded 65°F during July and August.

6.4.1.2.3 Habitat Access - Physical Barriers

Although not specifically for Chinook salmon EFH, a channel morphology study focusing on channel morphology, riparian vegetation and sediment mobility was conducted in the river reaches upstream of Englebright Reservoir that are potentially affected by the Proposed Action was undertaken by YCWA during 2011 and 2012. The information summarized below provides an indication of Middle Yuba River channel conditions and physical barriers in areas of EFH that could be potentially affected by the Proposed Action upstream of Englebright Reservoir.

> The Middle Yuba River has a coarse and resistant bed and banks in most of its length, with few possibilities of lateral or vertical shifting. Locations on the upstream side of bends and within and downstream of long-term depositional areas are more alluvially dominated, but sediment transport is still very high and particles move with fairly high frequency. Sediment is available to the channel and being transported at a higher rate than it is replaced. The sediment deficit estimates highlight the fact that bedload transport equations rely on the ability of the channel to transport sediment as well as the availability of sediment for transport.
>
> The Log Cabin and Our House diversion dams are passive-spillway dams that spill regularly; these spills do not cause erosion of a spillway. There is pass-through of coarse and fine sediment downstream during large flood events below Our House Diversion Dam, and there may be pass-through over Log Cabin Diversion Dam of fine-grained material (e.g., washload).
>
> The quantity of mobile material (i.e., D_{84}, which is generally less than 128 mm) in the Middle Yuba River downstream of Oregon Creek was 6.9 m^3/m.
>
> Armoring ratio is strongest below Oregon Creek at 5.4 and considered strongly armored**,** but is moderate (between 1.4 and 2.7) at all other Middle Yuba River sites. The weakest armoring ratio is just above the Middle Yuba River/North Yuba River confluence, though it is still considered moderate.

In 2002, Vogel conducted a survey via helicopter of the Middle Yuba River to identify potential natural barriers to upstream steelhead and salmon passage for spawning. In August 2003 and 2005, he also conducted field assessments of the potential barriers identified from the helicopter. Vogel identified two types of barriers - high and low flow barriers, and considered the break between the two to be flows of about 100 to 200 cfs.

Gast et al. (2005) identified natural, low flow-only barriers to small fish passage at RM 0.2 and 3.2, and an estimated 13-foot high cascade at RM 0.4 that would be a major obstacle to upstream migration. At this location, several very large boulders blocking the narrow bedrock channel created the barrier, and sediment has filled in upstream of the boulders forming a dam. Although large fish may be able to pass at certain flows, the height of the cascade and narrowness of the canyon is expected to at least impede passage at all flows.

More recently, where access allowed, YCWA field crews identified potential barriers to upstream fish movement, as described in TM 3-10 and TM 3-8. Identification of potential natural upstream fish passage barriers was very general. The criteria included: (1) vertical height exceeding 2.5 feet; (2) waterfalls; or (3) high-velocity chutes. The analysis was performed for resident rainbow trout. YCWA's Study 3.8 included sampling two sites downstream of the confluence with Oregon Creek on the Middle Yuba River at RM 3.3 (downstream of Moonshine Creek) and at RM 1.0 (downstream of Yellowjacket Creek). The RM 3.3 site reportedly was devoid of LWM and fish passage impediments. Fish passage impediments were not detected at the RM 1.0 site.

According to TM 3-10, although there may be additional barriers upstream and downstream of the mapped section, but the number of barriers within the mapped section can be used as an indicator of the relative restrictions to upstream salmonid movement. Two potential natural barriers to upstream movement of resident trout were mapped on the ground, and Vogel (2006) also identified two low-flow barriers in the Middle Yuba River – Oregon Creek and Our House Diversion Dam Reach.

6.4.1.3 Yuba River Upstream of Englebright Reservoir

6.4.1.3.1 Flow-Related Instream Habitat

The 7.1 mile channel of the Yuba River – Middle/North Yuba River and New Colgate Powerhouse Reaches - is dominantly bedrock-controlled, with only very short boulder/cobble sections. The channel is laterally and vertically stable due to dominant bedrock control. Sinuosity is very low as there are no plan and profile sections strongly influenced by alluvial deposition. Pools are large and deep, and separated by long sections of pocketwater that runs through and under very large boulders. Finer sediment (cobble and finer) accumulations are not common.

This confined bedrock-dominated reach is very inaccessible. Though not very steep, according to the mapped gradient of 1.8 percent, high gradient riffles dominate the gradient "steps." The river flows through bedrock canyons, and the vertical walls inhibit ground access. The only location that was ground-mapped was the area just above and below New Colgate Powerhouse (25% of the reach). Habitat is dominated by mid-channel pools and pocket water formed between large boulders (Table 6.4.1-6). Boulders are the only instream cover identified; though deep pools likely also provide cover. Large woody debris was not found and trout spawning-sized gravel accumulations were uncommon (Table 6.4.1-7).

6.4.1.3.2 Thermal Refugia (Water Temperatures)

Mean daily water temperatures monitored in EFH reaches of the Yuba River upstream of Englebright Dam potentially affected by the Proposed Action (i.e., three locations in the Yuba

River: below the Middle Yuba and North Yuba confluence, above New Colgate Powerhouse and above Englebright Reservoir) during Water Years 2009 through 2012 are presented in Figure 6.4.1-3. In general, water temperatures between the confluence and above the powerhouse were similar. Mean daily water temperatures below project facilities in the Yuba River upstream of Englebright Reservoir were less than 68°F (20°C) except for approximately 66 percent of days from June through September near the Middle Yuba-North Yuba rivers confluence and 67 percent of the days from June through October upstream of New Colgate Powerhouse release. The maximum mean daily water temperature recorded in the Yuba River upstream of Englebright Reservoir was 79.5°F (26.4°C) during July 2010.

Differences from year to year were likely the result of spill timing and intensity from New Bullards Bar Reservoir, Our House Diversion Dam and Log Cabin Diversion Dam. Water temperatures below New Colgate Powerhouse were cooled by the release of cold water drawn from the intake structure at New Bullards Bar Reservoir, usually about 50°F (10°C). During the summer, water temperatures in the reach between New Colgate Powerhouse and Englebright Reservoir were 10°C-15°C cooler than those observed upstream of the powerhouse. As described above, the sharp decrease in water temperatures in August was caused when the low-level outlet at New Bullards Bar Dam increased releases to over 1,000 cfs due to an outage downstream at New Colgate Powerhouse, which was caused by a forest fire that burned in the vicinity of the powerhouse and associated structures.

Table 6.4.1-6. Length, frequency, width and depth of ground-mapped habitat units for the Mainstem Yuba River – New Colgate Powerhouse and Middle/North Yuba River Reaches (between the New Colgate Powerhouse and the Middle/North Yuba junction). The shaded cells are characteristics of pools that do not apply to non-pool habitat types.

Unit Type	Total Length (ft)	Length Relative Frequency	Number	Number of Units (frequency)	Average width (ft)	Average pool depth (ft)	Average maximum pool depth (ft)	Average pooltail embeddedness (%)
Fall	--	--	--	--	--			
Cascade	--	--	--	--	--			
Chute	--	--	--	--	--			
Rapid	989	10.1%	4	12.1%	117.5			
High Gradient Riffle	791	8.1%	5	15.2%	73.3			
Low Gradient Riffle	845	8.6%	6	18.2%	92.4			
Glide	235	2.4%	1	3.0%	176.5			
Run	1,148	11.7%	5	15.2%	121.3			
Step Run	--	--	--	--	--			
Pocket Water	812	8.3%	3	9.1%	89.5			
Sheet	--	--	--	--	--			
Convergence Pool	--	--	--	--	--	--	--	--
Mid-Channel Pool	4,978	50.8%	9	27.3%	104.7	6.6	11.1	Too Deep
Lateral Scour Pool	--	--	--	--	--	--	--	--
Trench Pool	--	--	--	--	--	--	--	--

Table 6.4.1-6. (continued)

Unit Type	Total Length (ft)	Length Relative Frequency	Number	Number of Units (frequency)	Average width (ft)	Average pool depth (ft)	Average maximum pool depth (ft)	Average pooltail embeddedness (%)
Plunge Pool	--	--	--	--	--	--	--	--
TOTAL	**9,798**	**100.0%**	**33**	**100.0%**	**104.8**	**6.6**	**11.1**	**Likely Not**

Table 6.4.1-7. Summary of ground mapped data for the Mainstem Yuba River – New Colgate Powerhouse and Middle/North Yuba River Reaches (between the New Colgate Powerhouse and the Middle/North Yuba junction).

Total Reach Length	7.5 miles
Total Ground Mapped Length	1.86 miles (24.7%)
Average Bankfull Width	104.8 feet
Average Bankfull Depth	6.5 feet
Average Width:Depth	16
Total Spawnable Gravel	1,405 $feet^2$ - trout
Average Largest Patch Size	93 $feet^2$ - trout
LWD Density	0 / mile (within bankfull width)
Wetted LWD Density	0 / mile (within wetted width)
Parent Material	Volcanic (Smartville Complex), gabbro (Pleasant Valley Pluton), quartz diorite
Bank Erosion % of Reach	0.0%
Total No. Passage Barriers	0

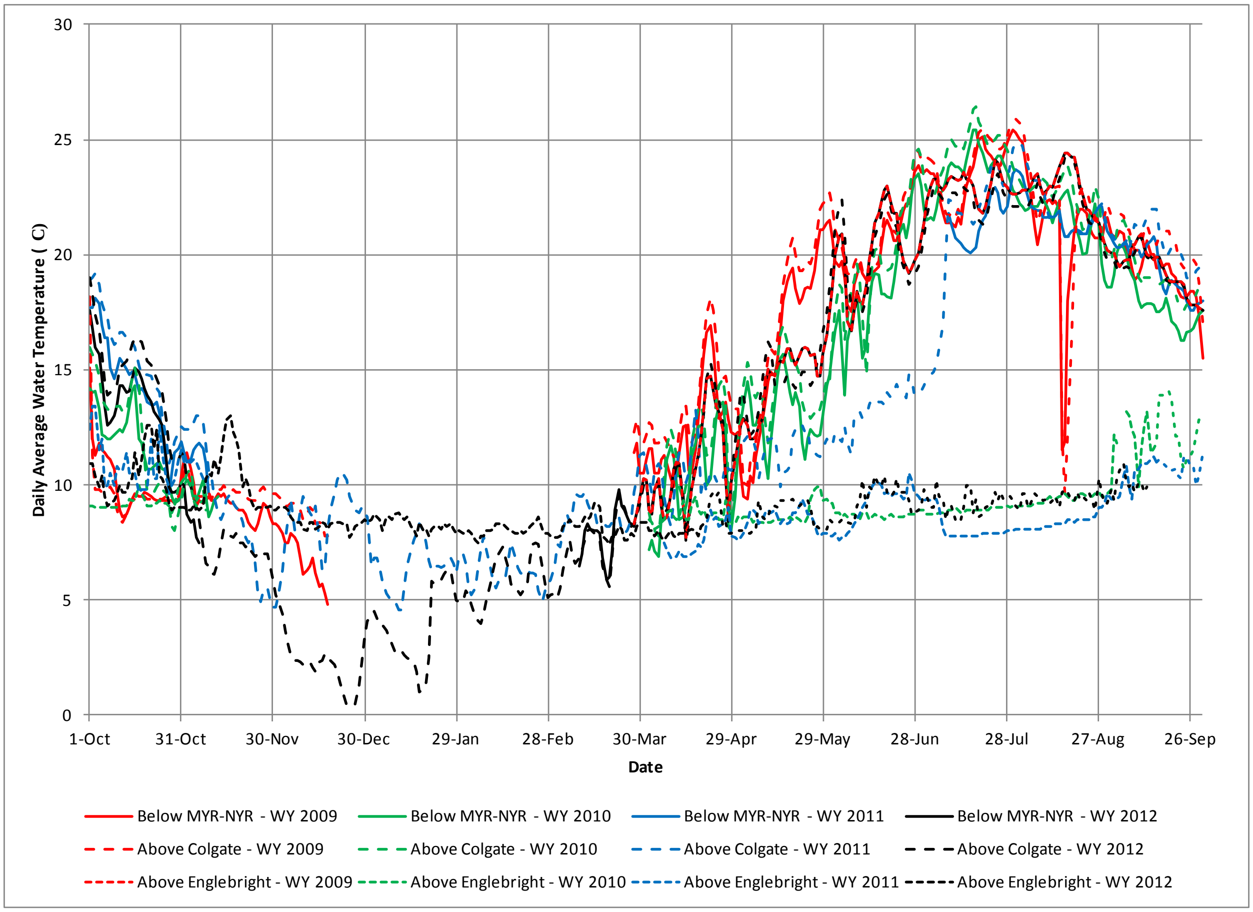

Figure 6.4.1-3. Mean daily water temperatures in the Yuba River from the Middle and North Yuba rivers downstream to above the normal-maximum water-surface elevation of the Corps' Englebright Reservoir during Water Years 2009, 2010, 2011 and 2012.

Monitoring results during the July through December fall-run Chinook salmon adult immigration and staging period indicated that, if fish were able to access areas upstream of Englebright Dam, maximum daily average water temperatures in the Yuba River downstream of Dobbins Creek (i.e., the lowermost monitoring site) did not exceed the upper tolerance WTI of 68°F (20°C) during any of the years (2009 through 2012) sampled. However, the 68°F WTI value was exceeded during all years in July, August and September at the Yuba River site downstream of confluence of North Yuba River and Middle Yuba River, and at the Yuba River site upstream of New Colgate Powerhouse. Of the sites monitored during the December through June fall-run Chinook salmon juvenile rearing and downstream movement period, maximum daily average water temperatures exceeded the upper tolerance WTI of 65°F (18.3°C) during May 2009 and 2012 and June 2009, 2010 and 2012 at the Yuba River downstream of the confluence of North Yuba River and Middle Yuba River, and during May 2009 and 2012 and June 2009, 2010 and 2012 at the Yuba River upstream of New Colgate Powerhouse.

Similarly, monitoring results indicate that during the April through September spring-run Chinook salmon adult immigration and holding period, maximum daily average water temperatures exceeded the upper tolerance WTI of 68°F during most months at the two upstream sites (Yuba River downstream of the confluence of the North Yuba River and Middle Yuba River, and the Yuba River upstream of New Colgate Powerhouse). During the year-round spring-run Chinook salmon juvenile rearing and downstream movement period, maximum daily average water temperatures met or exceeded the upper tolerance WTI of 65°F during most months from June through September at the two upstream sites (Yuba River downstream of the confluence of the North Yuba River and Middle Yuba River, and the Yuba River upstream of New Colgate Powerhouse). Maximum daily average water temperatures did not exceed 65°F in the Yuba River downstream of New Colgate Powerhouse and downstream of Dobbins Creek during the 2009 through 2012 monitoring period.

6.4.1.3.3 Habitat Access - Physical Barriers

Although not specifically for Chinook salmon EFH, a channel morphology study in the river reaches upstream of Englebright Reservoir that are potentially affected by the Proposed Action was undertaken by YCWA during 2011 and 2012. The information summarized below provides an indication of Yuba River channel conditions and physical barriers in areas of EFH that could be potentially affected by the Proposed Action upstream of Englebright Reservoir.

> The Yuba River upstream of the New Colgate Powerhouse generally exhibits coarse bed and banks resistant to movement, and storage of sediment in small areas in deep pools, in velocity shadows, and on lateral bars. Mid-channel bars are uncommon, but do exist, although whether or not they have been reduced in size or frequency since New Bullards Bar Dam construction is unknown.
>
> The Yuba River downstream of the New Colgate Powerhouse is a reach that appears to be accumulating sediment. The long-term bars (e.g., Rice's, French and Condemned) that existed before the Project will continue to exist, though there are some indications that the channel could shift to occupy French and Rice's bars. Because there are numerous floods within this most downstream section of the upper Yuba River, shifting is not only possible, but likely.
>
> The banks downstream of New Colgate Powerhouse are generally stable, mostly bedrock and boulder, with only a minor amount of bank erosion that could be due to peaking flows from the New Colgate Powerhouse.
>
> The Yuba River below the New Colgate Powerhouse has a gradient of 0.2 percent, which reportedly decreases as floodprone flows increase depth, indicating a likely influence of backwater effects from Englebright Reservoir that extends into the survey site (see Section 3.3 of Exhibit E).

Vogel also surveyed, via helicopter during 2002 and by field assessments during 2003 and 2005, the Yuba River above the Corps' Englebright Reservoir to identify potential natural barriers to upstream steelhead and salmon passage. Vogel (2006) did not identify any barriers in this reach of the Yuba River upstream of Englebright Reservoir. More recently, YCWA surveyed (see Study 3.8 and Study 3-10) two sites on the Yuba River upstream of New Colgate Powerhouse: (1) at RM 39.6, below the confluence of Middle Yuba and North Yuba rivers; and (2) at RM

35.0, upstream of New Colgate Powerhouse. Both sites reportedly were devoid of fish passage impediments. The Yuba River (RM 33.7) between New Colgate Powerhouse and Englebright Reservoir also was surveyed, but fish passage impediments were not documented. While there were no natural barriers to upstream resident trout movement noted during ground-based habitat mapping of the 7.1 mile channel of the Yuba River between the Middle/North Yuba River confluence and New Colgate Powerhouse, this confined bedrock-dominated reach is very inaccessible and it is reported that barriers are likely to occur in this reach of the Yuba River (see TM 3-10).

6.4.2 Downstream of Englebright Dam

6.4.2.1 Lower Yuba River

6.4.2.1.1 Flow-Related Physical Instream Habitat

The NMFS Draft Recovery Plan (NMFS 2009b) states that "*For currently occupied habitats below Englebright Dam, it is unlikely that habitats can be restored to pre-dam conditions, but many of the processes and conditions that are necessary to support a viable independent population of spring-run Chinook salmon can be improved with provision of appropriate instream flow regimes, water temperatures, and habitat availability. Continued implementation of the Yuba Accord is expected to address these factors and considerably improve conditions in the lower Yuba River*." As acknowledged by NMFS in this statement, stressors associated with instream flows and water temperatures affecting Chinook salmon migration habitat in the lower Yuba River have been addressed, to the extent feasible within hydrological constraints, by the Yuba Accord. However, because the Proposed Action has the potential to change instream habitat conditions in the lower Yuba River, characterization of existing flow-dependent habitat availability (and water temperature suitabilities) is provided in the following sections.

Flow schedules specified in the Fisheries Agreement of the Yuba Accord were first implemented on a pilot program basis in 2006 and 2007, and early 2008, and then were implemented on a long-term basis in 2008, after the SWRCB made the necessary changes to YCWA's water right permits. Continued implementation of the Yuba Accord addresses flow-related major stressors, including flow-dependent habitat availability, flow-related habitat complexity and diversity, and water temperatures, and considerably improves conditions in the lower Yuba River (NMFS 2009).

Narrows 2 Operations, Flow Changes and Adult Chinook Salmon Movement

YCWA's continued operation of the Project has the potential to affect anadromous salmonid fish species in the Yuba River near the Project's Narrows 2 Powerhouse. YCWA conducted a specific study (Technical Memorandum 7-11) to document potential fish behavior responses to Narrows 2 powerhouse operations. Fish behavior was monitored by snorkeling from May through December 2012. General behavior of adult salmonids was milling, with a tendency to flee when the fish observed the biologists. Fish were never observed entering the draft tube or interacting directly with the Narrows 2 Powerhouse.

Four operational events (i.e., planned flow changes of 400 cfs or greater) that occurred at Narrows 2 Powerhouse were monitored by a Dual-frequency Identification Sonar (DIDSON™) camera during 2012. Many fish were observed throughout the monitoring events but most (n=6,490 observations of behavior, 85.8%) were observed during full bypass operation. Most observations were less than a few seconds and fish were never observed entering or attempting to enter the draft tube.

Phase 2 of the study (7-11a) will include tagging and tracking both the phenotypic spring-run and fall-run Chinook salmon, and will occur in 2014. The objective is to document the movement and behavior of spring-run and fall-run Chinook salmon using telemetry, and to determine any correlation between the movement and behavior of tagged fish and project operations.

For this EFH assessment, additional analyses of available data were undertaken in order to address potential relationships between Project operations and resultant flow changes in the lower Yuba River and adult salmonid behavior. YCWA obtained data from the RMT to plot daily locations of each individual acoustically-tagged fish with monitored mean daily flows at the Smartsville Gage. Daily locations of each fish for each of the three study years (2009, 2010 and 2011) were plotted using both static receiver data and roving survey data. In order to first visually examine generalized daily locations of all acoustically-tagged fish in a given year, the location of each acoustically-tagged fish was averaged on a daily basis and plotted with mean daily Smartsville flow for each study year separately (2009, 2010 and 2011). To investigate potential relationships between individual fish movements and mean daily flow, daily time series of individual fish movements and mean daily Smartsville flows were visually examined to identify generalized patterns of movement in relation to flow. Appendix A of the Applicant-Prepared Draft BA provides figures of individual acoustically-tagged fish and flow at the Smartsville Gage, grouped by apparent relationships between individual fish movement and changes in flow. Individuals that that did not exhibit any readily apparent movement-flow relationships were excluded from this evaluation. Visual examination of changes in fish location and changes in flow was then used to quantify changes in individual fish movement (river miles) and associated changes in mean daily flow (cfs) over a specific time period (days) for a given individual.

6.4.2.1.2 Potential Relationships between Chinook Salmon Movements and Flows

Annual Generalized Chinook Salmon Locations and Flow

The mean daily location of all acoustically-tagged fish and mean daily flow at the Smartsville Gage during each survey year is shown in Figures 6.4.2-1, 6.4.2-2 and 6.4.2-3. The mean position of individuals was located in the vicinity of Daguerre Point Dam until approximately mid-August during 2009 and 2010, and until approximately late August during 2011. The mean fish location abruptly moved upstream during mid-August to mid-September in 2009, during early to late September in 2010, and during early September to early October in 2011. The abrupt upstream shift in the mean position of individuals during 2009 started just prior to a large reduction in flow over the period of approximately mid-August to early September. During 2010, the abrupt upstream shift in mean fish location started immediately after a large flow reduction over the period of approximately late August to early September. During 2011, the abrupt upstream shift in mean fish location started during late August, which coincided with the approximate midpoint of the large flow reduction over the period of mid-August and early September. During each of the three years, the average fish location continued to move upstream after the mid-August to early September flow reduction (into mid to late September during 2009 and 2010, and into early October in 2011).

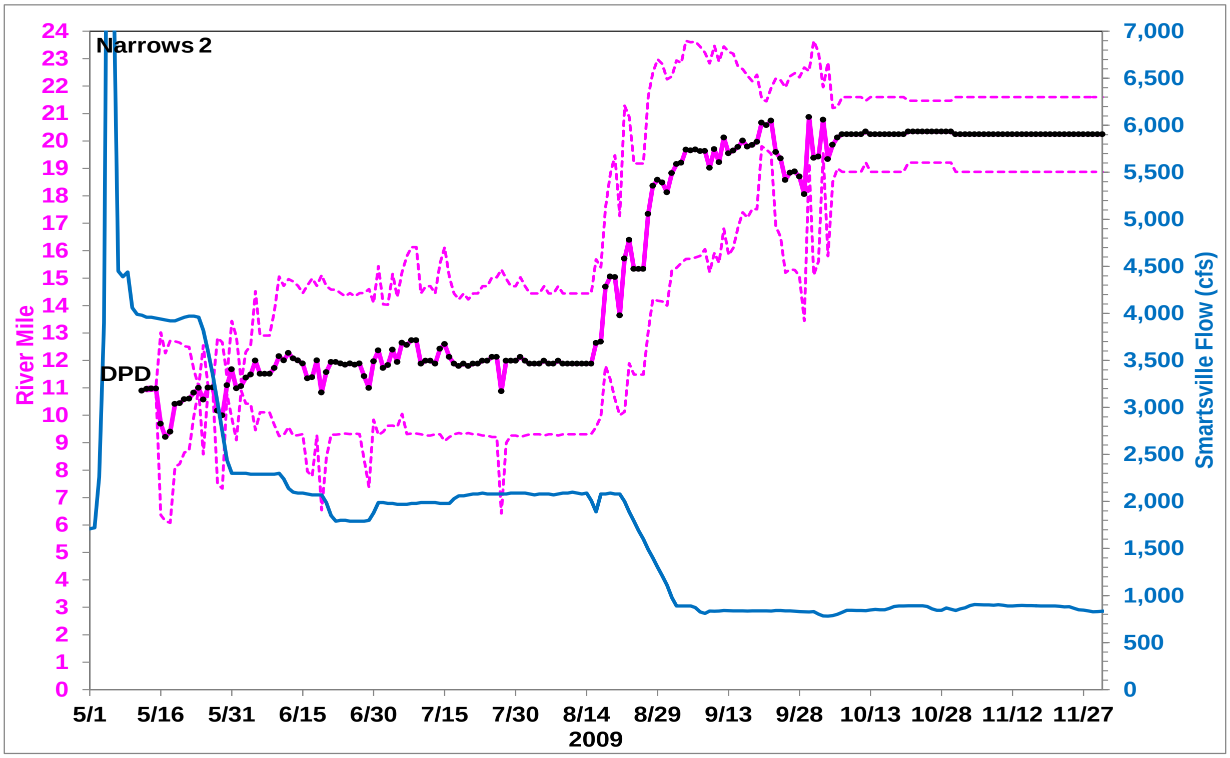

Figure 6.4.2-1. Average location (+/- 1 standard deviation) of all acoustically-tagged Chinook salmon during 2009.

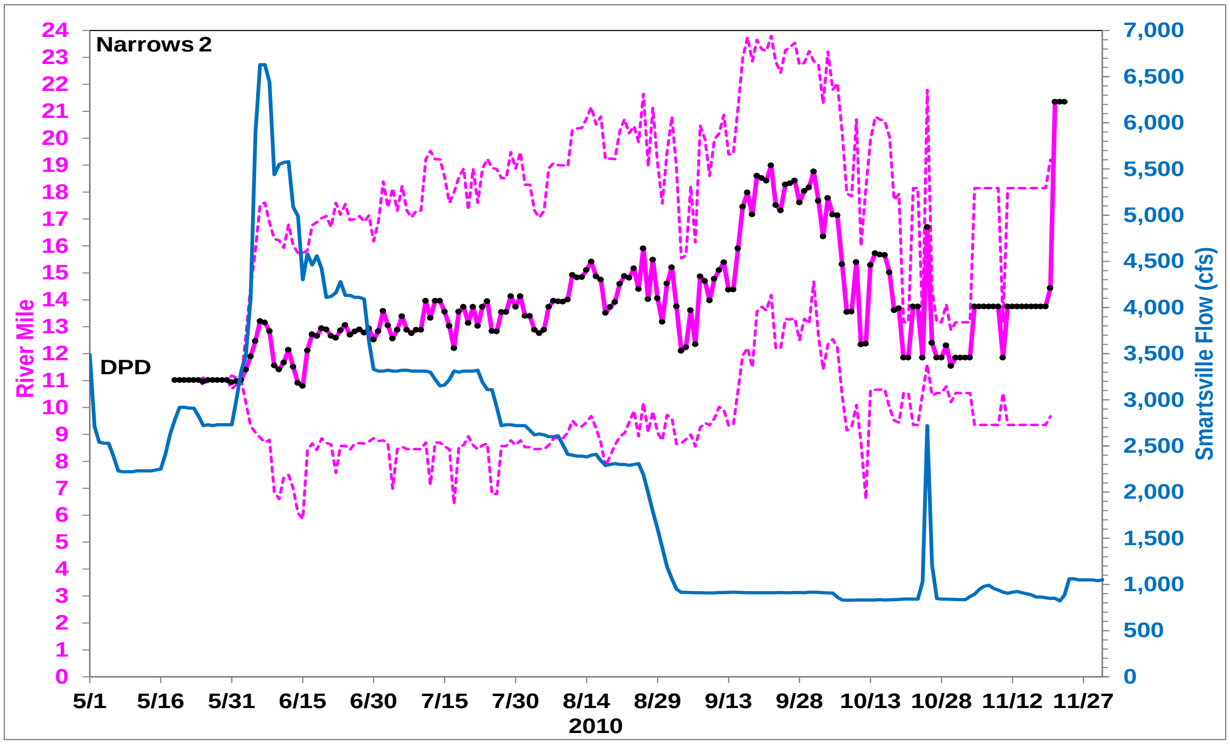

Figure 6.4.2-2. Average location (+/- 1 standard deviation) of all acoustically-tagged Chinook salmon during 2010.

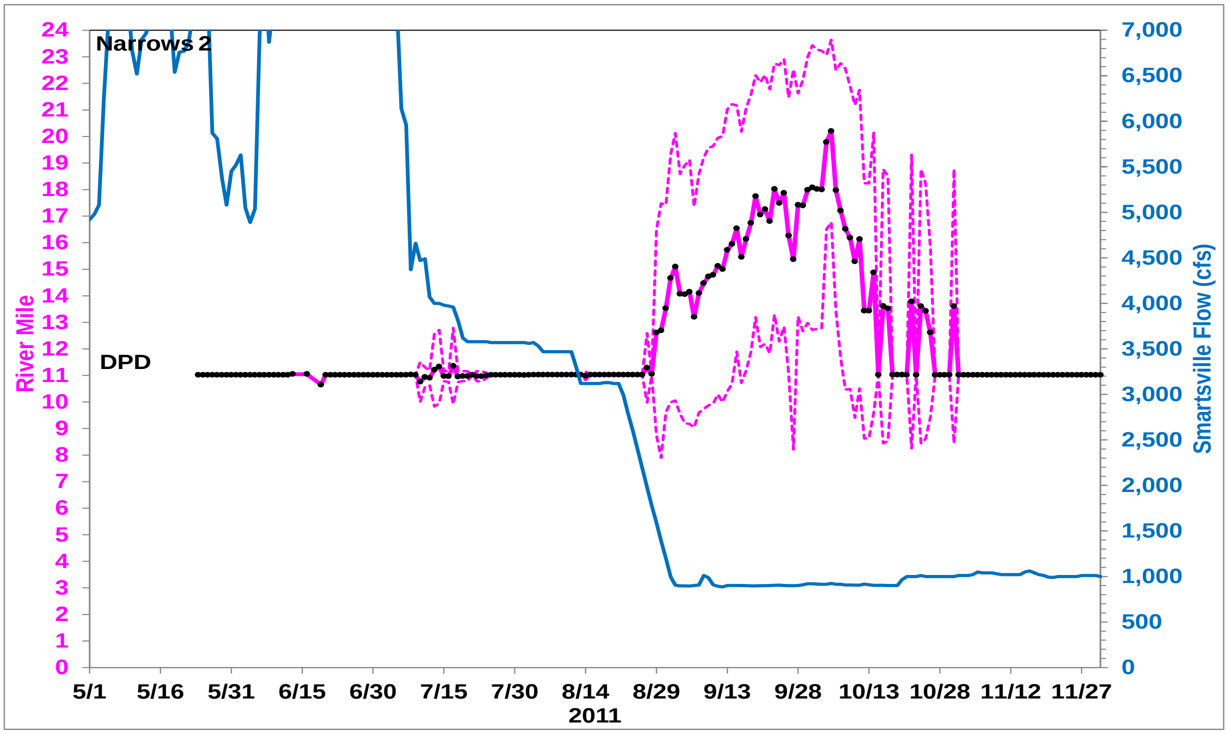

Figure 6.4.2-3. Average location (+/- 1 standard deviation) of all acoustically-tagged Chinook salmon during 2011.

Individual Chinook Salmon Movements and Flows

Visual examination of the time series plots of daily locations of individual acoustically-tagged Chinook salmon and mean daily flows at the Smartsville Gage presented in Appendix A show highly variable behavior among individuals on a daily basis within and among years. However, several general patterns of fish movement in relationship to flow are apparent.

- Abrupt upstream movement coinciding with an increase in flow (Figure A-1)
- Abrupt upstream movement coinciding with a decrease in flow (Figure A-2)
- Abrupt downstream movement coinciding with a decrease in flow (Figure A-3)
- Upstream movement occurring after an increase in flow (Figure A-4)
- Combination of abrupt upstream and/or downstream movements coinciding with an increase and/or decrease in flow (Figure A-5)

Subsequent to identification of visually abrupt changes in fish movement in an upstream or downstream direction coincident with a noticeable increase or decrease in mean daily flow, the distance an individual moved (river miles) and the change in flow (cfs) that occurred during the movement were calculated[25]. These tables (provided in the following sections) display the date, river mile and flow (cfs) associated with the beginning and the ending of the observed movement of an individual fish. The 'Difference (End-Start)' columns display the period (days) encompassing the observed movement, the distance the fish moved (river miles), and the flow change (cfs) that occurred during the observed movement. A positive value for 'Distance' indicates the fish moved upstream, while a negative value indicates that the fish moved downstream. A positive value for 'Flow' indicates the flow increased, while a negative value indicates that the flow decreased. For illustrative purposes, positive values for both distance and flow change are displayed in blue font (i.e., upstream movement; flow increase), while negative values for distance and flow change are displayed in red font (i.e., downstream movement; flow decrease).

2009 Chinook Salmon Movement-Flow Relationships. Visual observations of mean daily flows and daily movements of the 28 acoustically-tagged Chinook salmon during 2009 resulted in the identification of 17 individuals exhibiting 23 specific movements that were potentially related to changes in flow (Table 6.4.2-1). Observed movements generally occurred within the time period from about mid-May to early September, and generally occurred over a period ranging from one to nine days. More than half of these individual movements (i.e., 14) consisted of an upstream movement of an individual coincident with a decrease in flow. Most of the identified upstream movements occurring coincident to a decrease in flow occurred during either late August into early September, or during late May. Flow decreased from about 2,100 cfs to about 900 cfs from about August 19 to September 5 (57% decrease in flow over about 2 weeks), and decreased from about 4,000 cfs to 2,300 cfs from about May 23 to May 31 (43% over about 1 week).

[25] It should be noted that Appendix A of the Draft BA includes some figures of individual fish that display movements that may be related to flow that are not included in these tables, due to the inability to calculate changes in movement and concurrent changes in flow (e.g., individuals that exhibited upstream movements *after* a large flow change, and individuals that exhibited abrupt upstream or downstream movements within the period of one day).

2010 Chinook Salmon Movement-Flow Relationships. Visual observations of mean daily flows and daily movements of the 30 acoustically-tagged Chinook salmon during 2010 resulted in the identification of 14 individuals exhibiting 21 specific movements that were potentially related to changes in flow (Table 6.4.2-2). Most of the observed movements potentially related to changes in flow occurred during early to mid-June, with a few movements occurring during August. The duration of the individual movements generally ranged from about 1 to 7 days. More than half of these individual movements (i.e., 12) consisted of an upstream movement of an individual coincident with a decrease in flow. Most of the identified upstream movements occurring coincident to a decrease in flow occurred during either late August into early September, or during June. Flow decreased from about 2,300 cfs to about 950 cfs from about August 24 to September 2 (59% decrease in flow over about 9 days), and decreased from about 6,630 cfs to 4,100 cfs from about June 6 to June 20 (38% decrease over about 2 weeks).

2011 Chinook Salmon Movement-Flow Relationships. Visual observations of mean daily flows and daily movements of the 32 acoustically-tagged Chinook salmon during 2011 resulted in the identification of 14 individuals exhibiting 16 specific movements that were potentially related to changes in flow (Table 6.4.2-3). The identified movements potentially related to flow generally occurred during late August into early September. The duration of the individual movements generally ranged from about 1 to 5 days. Most all of these individual movements (i.e., 14) consisted of an upstream movement of an individual coincident with a decrease in flow. Most of the identified upstream movements occurring coincident to a decrease in flow occurred when flow decreased from about 3,100 cfs to about 1000 cfs from about August 19 to September 1 (68% decrease in flow over about 2 weeks).

<u>Summary of Chinook Salmon Movements and Changes in Flow</u>

Analyses conducted by YCWA in this EFH assessment found that most of the individual movements of acoustically-tagged spring-run Chinook salmon potentially associated with a change in Smartsville flow were abrupt upstream movements occurring concurrently with a noticeable decrease in flow. Additional notable observations included some individuals that moved upstream in the days following a reduction in flow.

Table 6.4.2-1. 2009 Individual Fish Movements in Relation to Changes in Smartsville Flow.

Fish ID	Date		River Mile		Flow (cfs)		Difference (End-Start)		
	Start	End	Start	End	Start	End	Period (Days)	Distance (RM)	Flow Change (cfs)
58086	8/19/09	9/1/09	16.08	18.72	2,090	978	13	2.64	-1,112
58087	5/28/09	5/29/09	2.14	11.02	3,050	2,740	1	8.88	-310
58089	8/30/09	9/8/09	13.78	21.35	1,210	810	9	7.57	-400
58092	8/17/09	8/23/09	11.02	18.72	2,080	1,890	6	7.7	-190
	8/27/09	8/30/09	18.72	21.35	1,490	1,210	3	2.63	-280
58093	5/29/09	6/2/09	10.89	21.2	2,740	2,300	4	10.31	-440
58094	5/22/09	5/31/09	2.14	11.02	3,970	2,300	9	8.88	-1,670
	6/29/09	7/1/09	11.02	18.72	1,800	1,990	2	7.7	190
	8/31/09	9/9/09	18.72	20.64	1,110	836	9	1.92	-274
58095	6/29/09	6/30/09	2.14	11.02	1,800	1,880	1	8.88	80
58096	6/26/09	6/30/09	11.6	13.78	1,790	1,880	4	2.18	90
58097	5/22/09	5/28/09	11.02	2.14	3,970	3,050	6	-8.88	-920
58099	6/29/09	7/8/09	11.02	21.4	1,800	1,980	9	10.38	180
58100	5/23/09	5/25/09	7.16	2.14	3,970	3,820	2	-5.02	-150
	6/20/09	6/21/09	2.14	11.02	1,990	1,850	1	8.88	-140
58103	8/28/09	9/4/09	18.72	22.75	1,400	890	7	4.03	-510
58105	6/29/09	7/8/09	11.02	19.7	1,800	1,980	9	8.68	180
	8/26/09	9/2/09	19.7	21.4	1,600	890	7	1.7	-710
58107	6/29/09	7/8/09	11.02	17.4	1,800	1,980	9	6.38	180
58109	8/26/09	8/29/09	17.6	21.35	1,600	1,300	3	3.75	-300
	8/30/09	9/3/09	21.35	16.08	1,210	890	4	-5.27	-320
58112	8/17/09	8/23/09	11.02	22.75	2,080	1,890	6	11.73	-190
58113	5/29/09	6/5/09	10.89	20.64	2,740	2,290	7	9.75	-450

Table 6.4.2-2. 2010 Individual Fish Movements in Relation to Changes in Smartsville Flow.

Fish ID	Date		River Mile		Flow (cfs)		Difference (End-Start)		
	Start	End	Start	End	Start	End	Period (Days)	Distance (RM)	Flow Change (cfs)
35718	6/5/10	6/16/10	11.02	17.6	5,890	4,580	11	6.58	-1,310
	8/26/10	9/2/10	21.35	22.97	2,190	949	7	1.62	-1,241
35722	6/5/10	6/17/10	11.02	13.78	5,890	4,460	12	2.76	-1,430
35723	6/9/10	6/18/10	11	21.35	5,440	4,560	9	10.35	-880
	6/29/10	7/2/10	21.35	22.75	3,630	3,310	3	1.4	-320
35724	6/2/10	6/6/10	11.02	21.35	3,310	6,630	4	10.33	3,320
35725	6/5/10	6/12/10	11.02	16.08	5,890	5,580	7	5.06	-310
35727	6/2/10	6/4/10	11.02	20.64	3,310	4,100	2	9.62	790
35731	6/29/10	7/1/10	11.02	21.35	3,630	3,310	2	10.33	-320
35732	8/5/10	8/9/10	11.02	18.72	2,620	2,510	4	7.7	-110
35733	6/12/10	6/15/10	11.02	0.29	5,580	4,300	3	-10.73	-1,280
35734	6/11/10	6/15/10	11.02	0	5,570	5,090	4	-11.02	-480
	6/22/10	6/23/10	0	11.02	4,160	4,280	1	11.02	120
35735	8/8/10	8/11/10	11.02	18.72	2,610	2,400	3	7.7	-210
	8/16/10	8/21/10	18.72	22.97	2,410	2,300	5	4.25	-110
35736	6/10/10	6/17/10	11.02	7.54	5,550	4,460	7	-3.48	-1,090
	6/17/10	6/18/10	7.4	11.02	4,460	4,560	1	3.62	100
	6/23/10	6/26/10	11.02	16.08	4,280	4,110	3	5.06	-170
	8/6/10	8/12/10	20.64	22.97	2,600	2,390	6	2.33	-210
35741	6/16/10	6/22/10	11.02	19.7	4,580	4,160	6	8.68	-420
35742	6/10/10	6/15/10	10.4	0.29	5,550	4,300	5	-10.11	-1,250

Table 6.4.2-3. 2011 Individual Fish Movements in Relation to Changes in Smartsville Flow.

	Date		River Mile		Flow (cfs)		Difference (End-Start)		
Fish ID	Start	End	Start	End	Start	End	Period (Days)	Distance (RM)	Flow Change (cfs)
8704	7/8/11	7/13/11	11.05	16.08	4,370	4,000	5	5.03	-370
	7/17/11	8/23/11	16.08	14.8	3,960	2,790	37	-1.28	-1,170
	8/23/11	8/29/11	14.8	21.35	2,790	1,590	6	6.55	-1,200
8706	7/10/11	7/12/11	7.54	11.02	4,470	4,070	2	3.48	-400
8707	8/28/11	8/31/11	11.02	21.35	1,780	1,200	3	10.33	-580
8710	8/29/11	8/30/11	11.02	0.21	1,590	1,390	1	-10.81	-200
8711	8/29/11	9/1/11	11.02	19.9	1,590	996	3	8.88	-594
8713	8/29/11	9/7/11	11.03	20.64	1,590	906	9	9.61	-684
8714	8/28/11	9/2/11	11.02	22.97	1,780	904	5	11.95	-876
8715	8/28/11	8/30/11	11.02	21.35	1,780	1,390	2	10.33	-390
8717	8/31/11	9/4/11	11.02	22.97	1,200	896	4	11.95	-304
8718	8/30/11	8/31/11	11	17.41	1,390	1,200	1	6.41	-190
8721	8/28/11	9/2/11	11.02	22.75	1,780	904	5	11.73	-876
8727	8/28/11	8/29/11	11.02	21.35	1,780	1,590	1	10.33	-190
8730	8/29/11	8/31/11	11.03	21.35	1,590	1,200	2	10.32	-390
8732	8/28/11	8/29/11	11.02	21.35	1,780	1,590	1	10.33	-190

The mean location of acoustically-tagged fish generally abruptly moved upstream of Daguerre Point Dam during mid-August to mid-September in 2009, during early to late September in 2010, and during early September to early October in 2011. The abrupt upstream shift in the mean position of individuals during 2009 started just prior to a large reduction in flow over the period of approximately mid-August to early September. During 2010, the abrupt upstream shift in mean fish location started immediately after a large flow reduction over the period of approximately late August to early September. During 2011, the abrupt upstream shift in mean fish location started during late August, which coincided with the approximate midpoint of the large flow reduction over the period of mid-August and early September. During each of the three years, the average fish location continued to move upstream after the mid-August to early September flow reduction (into mid- to late September during 2009 and 2010, and into early October in 2011).

Observed movements identified during 2009 generally occurred within the time period from about mid-May to early September, and generally occurred over a period ranging from one to nine days. Most of the observed movements identified during 2010 occurred during early to mid-June, with a few movements occurring during August, and generally occurred over a period ranging from about one to seven days. The identified movements identified during 2011 generally occurred during late August into early September, and generally occurred over a period ranging from about one to five days. Because spring-running Chinook salmon immigrated into the lower Yuba River later than during 2009 and 2010, and were not captured and acoustically-tagged until July, no potential relationships between fish movement and flow reductions during the spring months could be evaluated.

More than half (40 out of 60) of the identified movements of Chinook salmon over the three years that were potentially associated with a concurrent change in flow consisted of upstream movements coinciding with a large decrease in flow (measured at the Smartsville Gage). Most of the identified upstream movements occurring coincident to a decrease in flow occurred when flow decreased substantially during a 1 to 2 week period in late August to early September and/or during a 1 to 2 week period during May or June, depending on the year. In other words, the most common potential relationship identified between spring-run Chinook salmon movement and flow was an abrupt and continued movement upstream to the upper reaches during a large reduction in mean daily Smartsville flow (38 to 68%) occurring over about 1 to 2 weeks. Due to limitations in the available data, potential intra-daily relationships between fish movement and flow could not be evaluated.

6.4.2.1.3 Thermal Refugia (Water Temperatures)

Water temperature is an important habitat component of migration corridors. Water temperature suitability evaluations conducted in the Draft BA presented an integrated lifestage-specific representation. For efficiency of presentation, this EFH assessment maintains that presentation format. Hence, in addition to the migration-related lifestages of Chinook salmon, this section also provides characterization of existing water temperature conditions for spawning and embryo incubation and juvenile rearing and downstream movement lifestages. Summary discussions of “thermal refugia” corresponding to each of the other organizational components (i.e., spawning and embryo incubation habitat, and juvenile rearing habitat) are provided in those sections.

During November 2010, the RMT prepared a technical memorandum (RMT 2010b) to review the appropriateness of the water temperature regime associated with implementation of the Yuba Accord using previously available data and information, updated in consideration of recent and ongoing monitoring activities conducted by the RMT since the pilot programs were initiated in 2006. The RMT’s objectives for that memorandum were to review and update the lifestage periodicities of target species in the lower Yuba River, identify the appropriate thermal regime for target fish species taking into account individual species and lifestage water temperature requirements, identify water temperature index values, assess the probability of occurrence that those water temperature index values would be achieved with implementation of the Yuba Accord, and to evaluate whether alternative water temperature regimes are warranted.

Since November 2010, additional water temperature monitoring and life history investigations of anadromous salmonids in the lower Yuba River have been conducted by the RMT. An update to the water temperature suitability evaluation in RMT (2010) was recently presented by the RMT in their Interim Monitoring and Evaluation Report (RMT 2013). The water temperature suitability evaluation conducted for this BA incorporates lifestage periodicity refinements presented in RMT (2013), additional water temperature monitoring data collected since that report was prepared, and utilizes the Project Relicensing daily water temperature model to evaluate simulated water temperatures over the modeled period of record (1970-2010).

Through review of previously conducted studies, as well as recent and currently ongoing data collection activities of the M&E Program, the RMT (2013) developed the following representative lifestage-specific periodicities for spring-run and fall-run Chinook salmon and primary locations for water temperature suitability evaluations. The locations used for water temperature evaluations correspond to Smartsville, Daguerre Point Dam, and Marysville.

- **Spring-run Chinook Salmon**
  - Adult immigration and holding (April through September) – Smartsville, Daguerre Point Dam, and Marysville
  - Spawning (September through mid-October) – Smartsville
  - Embryo incubation (September through December) – Smartsville
  - Juvenile rearing and outmigration (Year-round) – Daguerre Point Dam and Marysville
  - Yearling+ smolt emigration (October through mid-May) – Daguerre Point Dam and Marysville

- **Fall-run Chinook Salmon**
  - Adult immigration and staging (July through December) – Daguerre Point Dam and Marysville
  - Spawning (October through December) - Smartsville and Daguerre Point Dam
  - Embryo incubation (October through March) - Smartsville and Daguerre Point Dam
  - Juvenile rearing and outmigration (late-December through June) – Daguerre Point Dam and Marysville

Lifestage-specific water temperature index values used as evaluation guidelines for Chinook salmon were developed based on the information described in Attachment A to RMT (2010b), as well as additional updated information provided in Bratovich et al. (2012). These documents present the results of literature reviews that were conducted to: (1) interpret the literature on the effects of water temperature on the various lifestages of spring-run and fall-run Chinook salmon; (2) consider the effects of short-term and long-term exposure to constant or fluctuating temperatures; and (3) establish water temperature index (WTI) values to be used as guidelines for evaluation. Specifically, this present evaluation adopts the approach established by Bratovich et al. (2012) which uses the lifestage and species-specific upper optimum and upper tolerance WTI values. These WTI values were not meant to be significance thresholds, but instead provide a mechanism by which to compare the suitability of the water temperature regimes associated with implementation of the Yuba Accord. Spring-run Chinook salmon and fall-run Chinook salmon lifestage-specific WTI values are provided in Tables 6.4.2-4 and 6.4.2-5.

Table 6.4.2-4. Spring-run Chinook salmon lifestage-specific upper tolerance water temperature index values.

Spring-run Chinook Salmon Lifestage	Upper Tolerance WTI	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult Migration	68°F	□□	□□	□□	■■	■■	■■	■■	■■	■■	□□	□□	□□
Adult Holding	65°F	□□	□□	□□	■■	■■	■■	■■	■■	■■	□□	□□	□□
Spawning	58°F	□□	□□	□□	□□	□□	□□	□□	□□	■■	■□	□□	□□
Embryo Incubation	58°F	□□	□□	□□	□□	□□	□□	□□	□□	■■	■■	■■	■■
Juvenile Rearing and Downstream Movement	65°F	■■	■■	■■	■■	■■	■■	■■	■■	■■	■■	■■	■■
Smolt (Yearling+) Emigration	68°F	■■	■■	■■	■■	■□	□□	□□	□□	□□	■■	■■	■■

Table 6.4.2-5. Fall-run Chinook salmon lifestage-specific upper tolerance water temperature index values.

Lifestage	Upper Tolerance WTI	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult Immigration and Staging	68°F	□□	□□	□□	□□	□□	□□	■■	■■	■■	■■	■■	■■
Spawning	58°F	□□	□□	□□	□□	□□	□□	□□	□□	□□	■■	■■	■■
Embryo Incubation	58°F	■■	■■	■■	□□	□□	□□	□□	□□	□□	■■	■■	■■
Juvenile Rearing and Downstream Movement	65°F	■■	■■	■■	■■	■■	■■	□□	□□	□□	□□	□□	□■

Water Temperature Monitoring

Recent water temperature monitoring data in the lower Yuba River are available for the period extending from 2006 into June 2013, during which time operations have complied with the Yuba Accord. In general, the lowest water temperatures in the lower Yuba River are observed during January and February, and water temperatures steadily increase until mid-June or July, remain at relatively high values through September and steadily decrease thereafter. The coldest water temperatures are observed upstream at the Smartsville Gage, intermediate water temperatures occur at Daguerre Point Dam, and the warmest temperatures are observed downstream at the Marysville Gage for most months of the year. The least amount of spatial variation in water temperature is observed during late fall through winter months (i.e., late November through February), when water temperatures are similar at the three monitoring locations.

Figure 6.4.2-4 displays daily water temperature monitoring results from October 2006 through late June 2013 at the Smartsville, Daguerre Point Dam, and Marysville water temperature gages, superimposed with spring-run Chinook salmon lifestage-specific upper tolerance WTI values. Water temperatures at all three gages during the period evaluated are always below the upper tolerance WTI values for yearling+ smolt outmigration, juvenile rearing and outmigration, and adult immigration and holding. The upper tolerance spawning and embryo incubation WTI value is never exceeded at Smartsville, which is the only location evaluated for spring-run Chinook salmon spawning and embryo incubation.

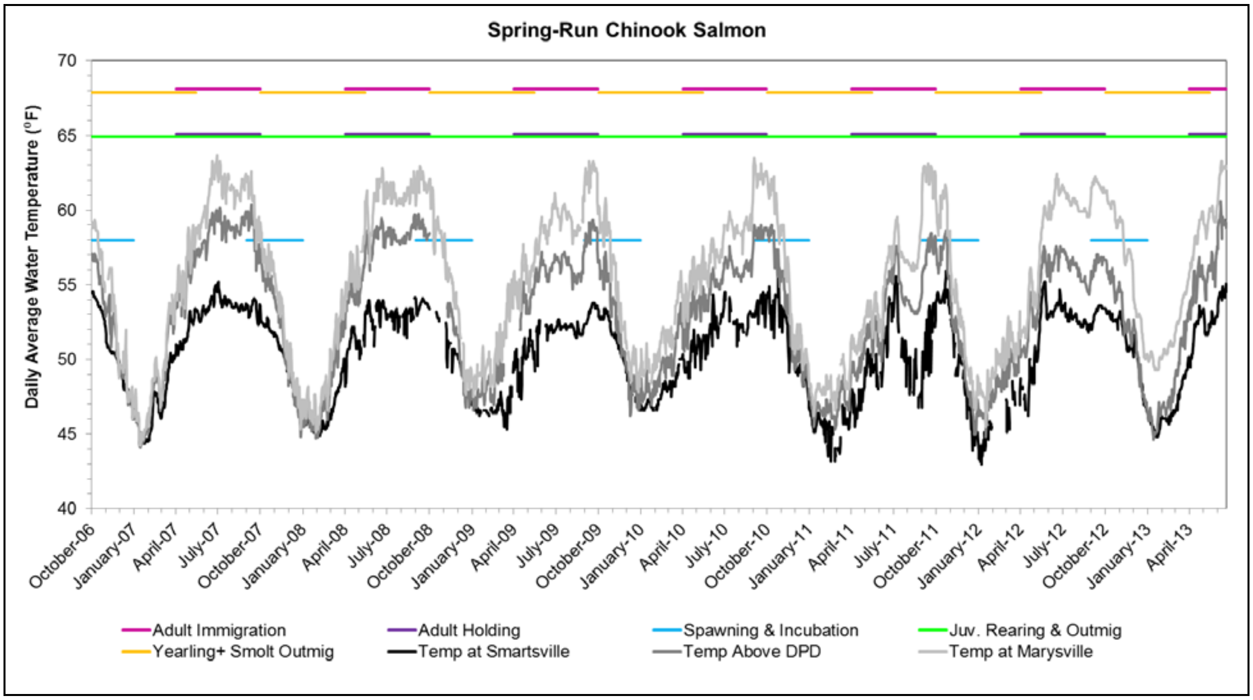

Figure 6.4.2-4. Monitored lower Yuba River water temperatures and spring-run Chinook salmon upper tolerance water temperature index values.

Figure 6.4.2-5 displays the daily water temperature monitoring results at the Smartsville, Daguerre Point Dam, and Marysville water temperature gages, with fall-run Chinook salmon lifestage-specific upper tolerance WTI values. Water temperatures at all three gages during the period evaluated are always below the upper tolerance WTI values for adult immigration and staging, and juvenile rearing and downstream movement. The upper tolerance spawning and embryo incubation WTI value is never exceeded at Smartsville, and water temperatures at Daguerre Point Dam generally remain below that value by the first few days of this lifestage in early October.

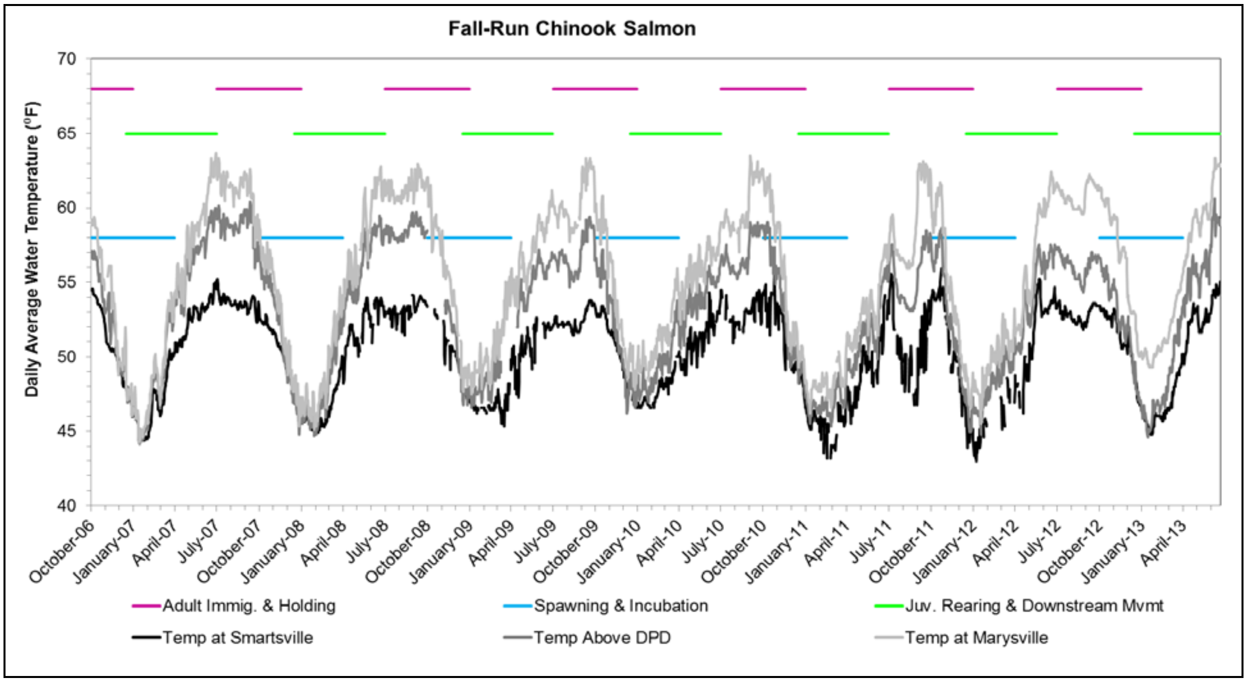

Figure 6.4.2-5. Monitored lower Yuba River water temperatures and fall-run Chinook salmon upper tolerance water temperature index values.

Water Temperature Modeling

Species- and lifestage-specific target water temperature index values were initially evaluated by the RMT (2010) using the monthly time-step statistical water temperature model results used in the Yuba Accord EIR/EIS (YCWA et al. 2007). As stated by RMT (2010), the water temperature suitability evaluation conducted at that time would be updated with application of a daily time-step water temperature model, when such a model became available, to provide greater resolution and to validate the exceedance estimates of the Yuba Accord Water Temperature Model. As previously mentioned, YCWA recently developed a daily HEC-5Q water temperature model for the lower Yuba River for the Project FERC Relicensing process. Documentation for that model, including details of model construction and validation, can be found on the YCWA Relicensing web site at www.ycwa-relicensing.com.

Output from the relicensing water temperature model is comprised of mean daily water temperatures occurring over a 41-year simulation period (WY 1970-2010). For this evaluation, simulated mean daily water temperatures were used for the following locations: (1) the Smartsville Gage; (2) below Daguerre Point Dam; and (3) the Marysville Gage.

Water temperature cumulative probability distributions have been developed for each half-month over the 41–year simulation period. Half-month water temperature cumulative probability distributions represent the probability, as a percent of time, that modeled water temperature values would be met or exceeded at an indicator location. For this evaluation, half-month cumulative probability distributions were used to examine the probability that the water temperature index values would be exceeded for the individual half-month periods within the identified lifestages, at the specified locations, for the target species.

Simulated mean daily water temperature model output has provided greater resolution than the previously available monthly Yuba Accord Water Temperature Model. The daily water temperature model exhibits the same seasonal and longitudinal trends in water temperature in the lower Yuba River observed through application of the monthly Yuba Accord Water Temperature Model, as well as trends observed from water temperature monitoring. Additionally, consistent with the monitoring results, simulated mean daily water temperatures (averaged by half-month period) during the summer can be up to approximately 4°F warmer at Daguerre Point Dam and 9°F warmer at the Marysville gage relative to the Smartsville gage. As demonstrated by both the monitoring results and model results, the range of temperatures at Marysville is seasonally dependent because of the rate of warming in the lower Yuba River, and is greatly influenced by air temperature, solar radiation, and volume of flow in the river (RMT 2010).

Consistent with the RMT (2010), the evaluation of water temperatures in the lower Yuba River in this EFH assessment primarily focuses on the identification of those periods during which the water temperature model results estimate a probability of exceeding the species- and lifestage-specific water temperature index values. An exceedance value of 10 percent or greater was used as an indicator of potentially impactive conditions for a specific species/run and lifestage. For example, the spring-run Chinook salmon spawning period is characterized as extending from September through mid-October. Application of model results (41 years) to this species/run and lifestage would indicate a potentially impactive condition if daily water temperatures exceeded the specified WTI value for 10 percent of the days evaluated during each one-half month period of this lifestage (41 years X 15 days = 615 days; 10% = 61 days). It should be noted that the sequential duration of exceedance of a water temperature index value was not considered, and a single day in a month where the average daily temperature exceeded the index value would likely be less impactive than a multi-day sequence where the average daily temperature exceeded the water temperature index value. However, all occasions where the average daily water temperature exceeded the index value are included in the calculation of exceedance probabilities. The following sections discuss specific species/runs/lifestages/months where model results indicate that water temperatures could exceed specified water temperature index values by 10 percent or more of the time, consistent with the approach used by RMT (2010).

Evaluation of water temperature suitabilities in this EFH assessment first presents results of the water temperature modeling for spring-run and fall-run Chinook salmon under existing conditions (i.e., the Environmental Baseline), followed by the Without-Project scenario.

Environmental Baseline Water Temperatures

<u>Spring-run Chinook Salmon</u>

Adult Immigration. Over the April through September adult immigration lifestage period, the water temperature index value of 68°F is not exceeded with a 10 percent or greater probability at any of the three evaluated locations (Table 6.4.2-6).

Table 6.4.2-6. Environmental Baseline modeled water temperature exceedances26 for spring-run Chinook salmon lifestage- and location-specific periodicities in the lower Yuba River at Smartsville (SMRT), below Daguerre Point Dam (DPD), and Marysville (MRY).

Spring-run Chinook Salmon Lifestage	Node	Upper Tolerance WTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration	SMRT	68°F							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
	Below DPD	68°F							0.0	0.0	0.0	0.0	0.0	0.0	1.6	2.4	2.4	2.4	2.4	2.3						
	MRY	68°F							0.0	0.0	0.0	0.3	2.0	2.6	2.8	2.6	2.4	2.7	2.4	2.4						
Adult Holding	SMRT	65°F							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
	Below DPD	65°F							0.0	0.0	0.0	0.0	0.3	1.6	2.4	2.4	2.4	2.4	2.4	2.4						
	MRY	65°F							0.2	0.2	0.3	2.4	6.7	9.4	16.6	19.1	13.3	13.7	7.0	3.6						
Spawning	SMRT	58°F																	2.4	2.4	2.4					
Embryo Incubation	SMRT	58°F																	2.4	2.4	2.4	1.1	0.0	0.0	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.6	2.4	2.4	2.4	2.4	2.4	2.4	0.7	0.0	0.0	0.0	0.0	0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.3	2.4	6.7	9.4	16.6	19.1	13.3	13.7	7.0	3.6	2.3	0.0	0.0	0.0	0.0	0.0
Yearling+ Smolt Emigration	Below DPD	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										0.0	0.0	0.0	0.0	0.0	0.0
	MRY	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										0.8	0.0	0.0	0.0	0.0	0.0

Adult Holding. Over the April through September adult holding lifestage period, the water temperature index value of 65°F is not exceeded with a 10 percent or greater probability at Smartsville or Daguerre Point Dam, but is exceeded with a 10 percent or greater probability at Marysville during July and August. However, over the 2007-2013 monitoring period, water temperatures at Marysville never exceeded or even reached 65°F during any time of the year. Additionally, the RMT's adult spring-run Chinook salmon acoustic tagging study found that adult spring-run Chinook salmon do not spend extended periods of time at downstream locations (e.g., Marysville). Adult spring-run Chinook salmon were found to primarily exhibit holding behavior just downstream of Daguerre Point Dam or above Daguerre Point Dam during their adult holding period (RMT 2013).

As described in RMT (2010), monitoring data indicate that water temperatures observed in the lower Feather River at Gridley (located approximately 20 miles upstream of the Feather-Yuba confluence) are warmer than those observed in the lower Yuba River at Marysville by 7°F to 16°F during June, 9°F to 14°F during July, and 11°F to 16°F during August for the 2008 and 2009 monitoring period; it is anticipated that temperatures in the Feather River at the Yuba-Feather confluence would be warmer still. Reducing lower Yuba River water temperatures during June, July, and August would further exacerbate the substantial water temperature difference between the lower Yuba River at Marysville and the lower Feather River at Gridley.

[26] Percent probability of mean daily temperature exceeding specified water temperature index values as estimated by the Project Daily Water Temperature Model.

Spawning. Over the September through mid-October spawning lifestage period, the water temperature index value of 58°F is not exceeded at the Smartsville location with a 10 percent or greater probability. While adult spring-run Chinook salmon exhibit extended durations of holding near Daguerre Point Dam, they consistently move upstream into the reaches near the Smartsville Gage shortly before spawning, so this is the only location evaluated for this lifestage.

Embryo Incubation. Over the September through December embryo incubation lifestage period, the water temperature index value of 58°F is not exceeded at the Smartsville location with a 10 percent or greater probability. Since spawning occurs primarily in this reach, embryo incubation also occurs at this location, which is therefore the only location evaluated in this analysis.

Juvenile Rearing and Downstream Movement. Over the year-round juvenile rearing and downstream movement lifestage period, the water temperature index value of 65°F is not exceeded with a 10 percent or greater probability during any month of the year at the Daguerre Point Dam location, but is exceeded with a 14-19 percent probability during July and August at the Marysville location. However, over the 2007-2013 monitoring period, water temperatures at Marysville never exceeded or reached 65°F during any time of the year. As previously discussed, water temperatures in the lower Feather River would be considerably higher than those in the Yuba River from spring through to fall.

Yearling+ Smolt Emigration. Over the October through mid-May yearling+ smolt emigration lifestage period, the water temperature index value of 68°F is not exceeded at either the Daguerre Point Dam or Marysville locations.

Fall-run Chinook Salmon

Adult Immigration and Staging. Over the July through mid-December adult immigration and staging lifestage period, the water temperature index value of 68°F is not exceeded with a 10 percent or greater probability at either the Daguerre Point Dam or Marysville locations (Table 6.4.2-7).

Table 6.4.2-7. Environmental Baseline modeled water temperature exceedances[1] for fall-run Chinook salmon lifestage- and location-specific periodicities in the lower Yuba River at Smartsville, Daguerre Point Dam, and Marysville.

Fall-run Chinook Salmon Lifestage	Node	Upper Tolerance WTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration and Staging	Below DPD	68°F													1.6	2.4	2.4	2.4	2.4	2.3	0.0	0.0	0.0	0.0	0.0	0.0
	MRY	68°F													2.8	2.6	2.4	2.7	2.4	2.4	0.8	0.0	0.0	0.0	0.0	0.0
Spawning	SMRT	58°F																			2.4	1.1	0.0	0.0	0.0	0.0
	Below DPD	58°F																			39.2	8.8	0.5	0.0	0.0	0.0
Embryo Incubation	SMRT	58°F	0.0	0.0	0.0	0.0	0.0	0.0													2.4	1.1	0.0	0.0	0.0	0.0
	Below DPD	58°F	0.0	0.0	0.0	0.0	0.0	0.0													39.2	8.8	0.5	0.0	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.6												0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.3	2.4	6.7	9.4												0.0

[1] Percent probability of mean daily water temperature exceeding specified water temperature index values as estimated by the Project Daily Water Temperature Model.

Spawning. Over the October through December spawning lifestage period, the water temperature index value of 58°F is not exceeded with a 10 percent or greater probability at the Smartsville location, although it is exceeded with a 39 percent probability at the Daguerre Point Dam location during the first half of October. However, fall-run Chinook salmon are primarily observed spawning during October in the upper reaches (upstream of Daguerre Point Dam) in the lower Yuba River. Spawning fall-run Chinook salmon begin expanding their spatial distribution further downstream in later fall months as suitable temperatures become available near or downstream of Daguerre Point Dam (RMT 2013).

Embryo Incubation. Over the October through March embryo incubation lifestage period, the water temperature index value of 58°F is not exceeded with a 10 percent or greater probability at the Smartsville location during any month evaluated, although it is exceeded with a 39 percent probability at the Daguerre Point Dam location during the first half of October. Because fall-run Chinook salmon are primarily observed spawning during October in the upper reaches upstream of Daguerre Point Dam, that is also where incubation would occur. As described above for the spawning lifestage, also applicable to the embryo incubation lifestage, spawning fall-run Chinook salmon begin expanding their spatial distribution further downstream in later fall months as suitable temperatures become available near or downstream of Daguerre Point Dam (RMT 2013).

Juvenile Rearing and Downstream Movement. Over the late-December through June juvenile rearing and downstream movement lifestage period, the water temperature index value of 65°F is rarely exceeded at either the Daguerre Point Dam or Marysville locations during all months evaluated, and is not exceeded with a 10 percent or greater probability during any month of this lifestage.

Without-Project Water Temperatures

<u>Spring-run Chinook Salmon</u>

Adult Immigration. Over the April through September adult immigration lifestage period, the water temperature index value of 68°F is exceeded with a 10 percent or greater probability from June through September at Marysville, late June through September at Daguerre Point Dam, and from July through September at Smartsville (Table 6.4.2-8). In fact, the index value is exceeded with 100 percent probability during late July through September at Daguerre Point Dam and Marysville.

Adult Holding. Over the April through September adult holding lifestage period, the water temperature index value of 65°F is exceeded with a 10 percent or greater probability from late May through September at Marysville, June through September at Daguerre Point Dam, and from late June through September at Smartsville. In fact, the index value is exceeded with 100 percent probability during late July through September at Daguerre Point Dam and Marysville, and with about 100 percent probability during August and September at Smartsville.

Spawning. Over the September through mid-October spawning lifestage period, the water temperature index value of 58°F is exceeded at the Smartsville location with about a 100 percent probability.

Embryo Incubation. Over the September through December embryo incubation lifestage period, the water temperature index value of 58°F is exceeded at the Smartsville location with a 10 percent or greater probability from September through mid-November, and with about a 100 percent probability during September and October.

Table 6.4.2-8. Without-Project modeled water temperature exceedances[1] for spring-run Chinook salmon lifestage- and location-specific periodicities in the lower Yuba River at Smartsville, below Daguerre Point Dam, and Marysville.

Spring-run Chinook Salmon Lifestage	Node	Upper Tolerance WTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration	SMRT	68°F							0.0	0.0	0.0	0.0	0.0	1.0	24.7	69.5	100.0	100.0	100.0	97.1						
	Below DPD	68°F							0.0	0.0	0.0	0.0	5.4	40.8	76.7	100.0	100.0	100.0	100.0	100.0						
	MRY	68°F							2.3	2.3	0.0	5.6	35.3	63.9	92.8	100.0	100.0	100.0	100.0	100.0						
Adult Holding	SMRT	65°F							0.0	0.0	0.0	0.0	0.2	13.2	53.2	89.3	100.0	100.0	100.0	99.7						
	Below DPD	65°F							0.0	0.0	0.0	0.6	29.3	60.2	94.3	100.0	100.0	100.0	100.0	100.0						
	MRY	65°F							2.3	2.4	1.8	16.2	49.3	73.5	97.9	100.0	100.0	100.0	100.0	100.0						
Spawning	SMRT	58°F																	100.0	100.0	97.6					
Embryo Incubation	SMRT	58°F																	100.0	100.0	97.6	96.8	46.0	1.1	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	29.3	60.2	94.3	100.0	100.0	100.0	100.0	100.0	97.6	57.2	1.8	0.0	0.0	0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	2.3	2.4	1.8	16.2	49.3	73.5	97.9	100.0	100.0	100.0	100.0	100.0	99.7	94.8	9.3	0.0	0.0	0.0
Yearling+ Smolt Emigration	Below DPD	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										89.8	20.1	0.0	0.0	0.0	0.0
	MRY	68°F	0.0	0.0	0.0	0.0	0.0	0.0	2.3	2.3	0.0										98.7	86.3	2.1	0.0	0.0	0.0

[1] Percent probability of mean daily temperature exceeding specified water temperature index values as estimated by the Project Daily Water Temperature Model.

Juvenile Rearing and Downstream Movement. Over the year-round juvenile rearing and downstream movement lifestage period, the water temperature index value of 65°F is exceeded with a 10 percent or greater probability from late-May through October at Marysville, and from June through October at Daguerre Point Dam. In fact, the index value of 65°F is exceeded with about a 100 percent probability from late July through early October at both locations evaluated.

Yearling+ Smolt Emigration. Over the October through mid-May yearling+ smolt emigration lifestage period, the water temperature index value of 68°F is exceeded with a 10 percent or greater probability at both Daguerre Point Dam and Marysville during October. In fact, 68°F is exceeded with a greater than 85 percent probability at Daguerre Point Dam during early October and at Marysville during all of October.

<u>Fall-run Chinook Salmon</u>

Adult Immigration and Staging. Over the July through mid-December adult immigration and staging lifestage period, the water temperature index value of 68°F is exceeded with a 10 percent or greater probability at both the Daguerre Point Dam and Marysville locations from July through October, and is exceeded 100 percent of the time during late July through September (Table 6.4.2-9).

Table 6.4.2-9. Without-Project modeled water temperature exceedances[1] for fall-run Chinook salmon lifestage- and location-specific periodicities in the lower Yuba River at Smartsville, Daguerre Point Dam, and Marysville.

Fall-run Chinook Salmon Lifestage	Node	Upper Tolerance WTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration and Staging	Below DPD	68°F													76.7	100.0	100.0	100.0	100.0	100.0	89.8	20.1	0.0	0.0	0.0	0.0
	MRY	68°F													92.8	100.0	100.0	100.0	100.0	100.0	98.7	86.3	2.1	0.0	0.0	0.0
Spawning	SMRT	58°F																			97.6	96.8	46.0	1.1	0.0	0.0
	Below DPD	58°F																			97.6	97.3	64.6	4.1	0.0	0.0
Embryo Incubation	SMRT	58°F	0.0	0.0	0.0	0.0	0.0	0.0													97.6	96.8	46.0	1.1	0.0	0.0
	Below DPD	58°F	0.0	0.0	0.0	0.0	0.0	0.0													97.6	97.3	64.6	4.1	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	29.3	60.2												0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	2.3	2.4	1.8	16.2	49.3	73.5												0.0

[1] Percent probability of mean daily water temperature exceeding specified water temperature index values as estimated by the Project Daily Water Temperature Model.

Spawning. Over the October through December spawning lifestage period, the water temperature index value of 58°F is exceeded with a 10 percent or greater probability at the Smartsville and Daguerre Point Dam locations during October and early November. The WTI value of 58°F is not exceeded during December. However, fall-run Chinook salmon are primarily observed spawning during October in the upper reaches (upstream of Daguerre Point Dam) in the lower Yuba River. Spawning fall-run Chinook salmon begin expanding their spatial distribution further downstream in later fall months as suitable temperatures become available near or downstream of Daguerre Point Dam (RMT 2013).

Embryo Incubation. Over the October through March embryo incubation lifestage period, the water temperature index value of 58°F is exceeded with a 10 percent or greater probability at the Smartsville and Daguerre Point Dam locations during October and early November. The WTI value of 58°F is not exceeded during December through March. Because fall-run Chinook salmon are primarily observed spawning during October upstream of Daguerre Point Dam, that is also where incubation would occur.

Juvenile Rearing and Downstream Movement. Over the late-December through June juvenile rearing and downstream movement lifestage period, the water temperature index value of 65°F is exceeded 10 percent or more of the time during June at Daguerre Point Dam and during late May through June at Marysville. This WTI value is rarely exceeded at either the Daguerre Point Dam or Marysville locations during the remainder of the months evaluated.

Environmental Baseline Compared to Without-Project Scenario

Tables 6.4.2-10 and 6.4.2-11 displays the differences in the species and lifestage-specific water temperature index value exceedance probabilities under the Environmental Baseline relative to the Without-Project scenario (i.e., the probability of exceeding a water temperature index value under the Environmental Baseline minus the probability of exceeding that water temperature index value under the Without-Project scenario).

Water temperature exceedance probabilities are generally similar and very low under the Environmental Baseline and Without-Project scenario during the winter through spring months (i.e., late November through early May) for most lifestages of spring-run and fall-run Chinook salmon.

Table 6.4.2-10. Difference in simulated water temperature exceedance probabilities for spring-run Chinook salmon lifestages under the Environmental Baseline, relative to the Without-Project scenario.

Spring-run Chinook Salmon Lifestage	Node	Upper Tolerance WTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration	SMRT	68°F							0.0	0.0	0.0	0.0	0.0	-1.0	-24.7	-69.5	-100.0	-100.0	-100.0	-97.1						
	Below DPD	68°F							0.0	0.0	0.0	0.0	-5.4	-40.8	-75.1	-97.6	-97.6	-97.6	-97.6	-97.7						
	MRY	68°F							-2.3	-2.3	0.0	-5.3	-33.3	-61.3	-90.1	-97.4	-97.6	-97.3	-97.6	-97.6						
Adult Holding	SMRT	65°F							0.0	0.0	0.0	0.0	-0.2	-13.2	-53.2	-89.3	-100.0	-100.0	-100.0	-99.7						
	Below DPD	65°F							0.0	0.0	0.0	-0.6	-28.9	-58.5	-91.9	-97.6	-97.6	-97.6	-97.6	-97.6						
	MRY	65°F							-2.1	-2.3	-1.5	-13.7	-42.6	-64.1	-81.3	-80.9	-86.7	-86.3	-93.0	-96.4						
Spawning	SMRT	58°F																	-97.6	-97.6	-95.1					
Embryo Incubation	SMRT	58°F																	-97.6	-97.6	-95.1	-95.7	-46.0	-1.1	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	-28.9	-58.5	-91.9	-97.6	-97.6	-97.6	-97.6	-97.6	-96.9	-57.2	-1.8	0.0	0.0	0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	-2.1	-2.3	-1.5	-13.7	-42.6	-64.1	-81.3	-80.9	-86.7	-86.3	-93.0	-96.4	-97.4	-94.8	-9.3	0.0	0.0	0.0
Yearling+ Smolt Emigration	Below DPD	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										-89.8	-20.1	0.0	0.0	0.0	0.0
	MRY	68°F	0.0	0.0	0.0	0.0	0.0	0.0	-2.3	-2.3	0.0										-97.9	-86.3	-2.1	0.0	0.0	0.0

Table 6.4.2-11. Difference in simulated water temperature exceedance probabilities for fall-run Chinook salmon lifestages under the Environmental Baseline, relative to the Without-Project scenario.

Fall-run Chinook Salmon Lifestage	Node	Upper Tolerance WTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration and Staging	Below DPD	68°F													-75.1	-97.6	-97.6	-97.6	-97.6	-97.7	-89.8	-20.1	0.0	0.0	0.0	0.0
	MRY	68°F													-90.1	-97.4	-97.6	-97.3	-97.6	-97.6	-97.9	-86.3	-2.1	0.0	0.0	0.0
Spawning	SMRT	58°F																			-95.1	-95.7	-46.0	-1.1	0.0	0.0
	Below DPD	58°F																			-58.4	-88.4	-64.1	-4.1	0.0	0.0
Embryo Incubation	SMRT	58°F	0.0	0.0	0.0	0.0	0.0	0.0													-95.1	-95.7	-46.0	-1.1	0.0	0.0
	Below DPD	58°F	0.0	0.0	0.0	0.0	0.0	0.0													-58.4	-88.4	-64.1	-4.1	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	-28.9	-58.5												0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	-2.1	-2.3	-1.5	-13.7	-42.6	-64.1												0.0

During spring through fall months (i.e., May through October), in general water temperatures are substantially more suitable for all lifestages spring-run and fall-run Chinook salmon that are evaluated during that time period under the Environmental Baseline relative to the Without-Project scenario. Specifically, water temperatures are substantially more suitable for the following lifestages and associated time periods.

- Spring-run Chinook salmon
  - Adult Migration (late June – September)
  - Adult Holding (June – September)
  - Spawning (September – mid October)
  - Embryo Incubation (September – mid November)
  - Juvenile Rearing and Downstream Movement (June – October)
  - Yearling+ Smolt Emigration (October)
- Fall-run Chinook salmon
  - Adult Immigration and Staging (July – October)
  - Spawning (October – early November)
  - Embryo Incubation (October – early November)
  - Juvenile Rearing and Downstream Movement (late May – June)

6.4.2.1.4 Habitat Access - Physical Barriers

Englebright Dam presents an impassable barrier to the upstream migration of anadromous salmonids, and marks the upstream extent of currently accessible Chinook salmon habitat in the lower Yuba River, whereas Daguerre Point Dam presents a potential impediment to upstream migration.

Englebright Dam

According to NMFS (2007, 2009), the greatest impact to listed anadromous salmonids in the Yuba River watershed is the complete blockage of access for these species to their historical spawning and rearing habitat above Englebright Dam. Because this historic habitat is no longer accessible, fall-run Chinook salmon are relegated to the lower 24 miles of the lower Yuba River from Englebright Dam to the confluence with the lower Feather River. Since construction of Englebright Dam in 1941, fall-run Chinook salmon are required to complete all of their riverine lifestages in the lower 24 miles of the lower Yuba River, which previously served primarily as a migratory corridor to upstream spawning and rearing habitats.

The 2007 NMFS BO identified the following non-flow related stressors associated with Englebright Dam: (1) blocking access of listed salmonids to the habitat above the dam; (2) forcing overlapping use of the same spawning areas by spring- and fall-run Chinook salmon below the dam; (3) forcing fish to spawn in a limited area without the benefit of smaller tributaries, which can provide some level of refuge in the event of catastrophic events; and (4) preventing the recruitment of spawning gravel and large woody material from upstream of the dam into the lower river.

Daguerre Point Dam

<u>Adult Upstream Migration</u>

Daguerre Point Dam is recognized as an impediment to upstream migration of adult salmon under certain conditions. When high flow conditions occur during winter and spring, adult Chinook salmon can experience difficulty in finding the entrances to the ladders because of the relatively low amount of attraction flows exiting the fish ladders, compared to the magnitude of the sheet-flow spilling over the top of Daguerre Point Dam. The angles of the fish ladder entrance orifices and their proximities to the plunge pool also increase the difficulty for fish to find the entrances to the ladders. However, because fall-run Chinook salmon migrate upstream in the lower Yuba River from mid-summer through fall, this is not believed to represent nearly as much of a stressor to fall-run Chinook salmon by contrast to spring-run Chinook salmon, as thoroughly described in the Draft BA. In addition, periodic obstruction of the ladders by sediment and woody debris has blocked passage or substantially reduced attraction flows at the ladder entrances in recent years.

Sheet flow across the dam's spillway, particularly during high-flow periods, may obscure ladder entrances and, thus, makes it difficult for immigrating adult salmonids to find the entrances (NMFS 2007). For example, fall-run Chinook salmon have been observed attempting to leap over the dam, demonstrating that these fish may have difficulty in finding the fish ladder entrances (Corps 2000). This phenomenon may particularly affect spring-run Chinook salmon, because peak spring-run adult Chinook salmon upstream migration occurs primarily during the relatively high-flow periods of spring through early summer. Since 2001, wooden flashboards have been periodically affixed to the crest of the dam during low flow periods to aid in directing the flows towards the fish ladder entrances. Fish passage monitoring data from 2006 indicates that the installation of the flashboards resulted in an immediate and dramatic increase in the passage of salmon up the ladders, and is thought to have improved the ability of salmon to locate and enter the ladders (NMFS 2007).

Both the north and south fish ladders at Daguerre Point Dam, particularly the north ladder, historically tended to clog with woody debris and sediment, which had the potential to block passage or substantially reduce attraction flows at the ladder entrances. Additionally: (1) the north and south ladders' exits are close to the spillway, potentially resulting in adult fish exiting the ladder being immediately swept by flow back over the dam; (2) sediment accumulates at the upstream exits of the fish ladders, reducing the unimpeded passage from the ladders to the main channel, and may cause potential "fall-back" into the ladders; and (3) fish could jump out of the upper bays of the fishway, resulting in direct mortality. Many of the past issues associated with woody debris accumulation have either been eliminated or minimized since locking metal grates were installed over the unscreened bays on the north and south fish ladders during 2011.

The RMT (2013) examined passage of adult Chinook upstream of Daguerre Point Dam and corresponding flow data during eight years of available data. Chinook salmon passage was observed over a variety of flow conditions, including ascending or descending flows, as well as during extended periods of stable flows. Flow thresholds prohibiting passage of Chinook salmon through the ladders at Daguerre Point Dam were not apparent in the data (RMT 2013).

Phenotypic spring-run Chinook salmon (those entering the lower Yuba River during spring months) may remain in the lower Yuba River in areas downstream (and proximate) to Daguerre Point Dam for extended periods of time during the spring and summer. It is uncertain whether, or to what extent, the duration of residency in the large pool located downstream of Daguerre Point Dam is associated with upstream passage impediment and delay, or volitional habitat utilization prior to spawning in upstream areas. However, RMT (2013) reported that temporal migrations of adult phenotypic spring-run Chinook salmon to areas upstream of Daguerre Point Dam occurred over an extended period of time. The tagged spring-run Chinook salmon in the lower Yuba River actually migrated upstream of Daguerre Point Dam from May through September, and utilized a broad expanse of the lower Yuba River during the phenotypic summer holding period, including areas as far downstream as Simpson Lane Bridge (i.e., ~RM 1.8), and as far upstream as the area just below Englebright Dam. A longitudinal analysis of acoustic tag detection data indicated that distributions were non-random, and that the tagged spring-run Chinook salmon were selecting locations for holding (RMT 2013).

It is not possible to assess if, or the manner in which, extended duration of holding below Daguerre Point Dam could potentially change spawning distribution, because no base data are available for conditions without the presence of Daguerre Point Dam. However, during the extensive pilot redd survey conducted during 2008-2009 (RMT 2010a), 33 percent of all Chinook salmon redds were observed by the first week of October, compared with 37 percent of all Chinook salmon redds observed by the first week of October during the redd surveys conducted in 2009-2010 (Campos and Massa 2010). Moreover, 74 percent of all Chinook salmon redds were observed upstream of Daguerre Point Dam during the extensive pilot redd survey conducted during 2008-2009, and the same exact percentage (74%) of all Chinook salmon redds were observed upstream of Daguerre Point Dam during the redd surveys conducted in 2009-2010. The similar distribution in timing and the same percentage distribution of Chinook salmon redds located upstream of Daguerre Point Dam occurred despite considerable differences in flow (monthly average cfs) that occurred from late spring into fall of 2008 compared to flow during 2009.

NMFS (2007) suggested that delays resulting from adult spring-run Chinook salmon adult passage impediments could weaken fish by requiring additional use of fat stores prior to spawning, and potentially could result in reduced spawning success (i.e., production) from reduced resistance to disease, increased pre-spawning mortality, and reduced egg viability. However, these statements suggesting biological effects associated with fish passage issues at Daguerre Point Dam are not supported by studies or referenced literature. For example, the RMT (2010b) included evaluation of water temperatures at Daguerre Point Dam during the spring-run Chinook salmon adult upstream immigration and holding lifestage, which addressed considerations regarding both water temperature effects to pre-spawning adults and egg viability. They concluded that during this lifestage, characterized as extending from April through August, water temperatures [modeled] at Daguerre Point Dam are suitable and remain below the reported optimum water temperature index value of 60°F at least 97 percent of the time over all water year types during these months. Thus, it is unlikely that this represents a significant source of mortality to spring-run Chinook salmon. Moreover, actual data monitored since the Yuba Accord has been implemented (October 2006 to June 2013) demonstrates that water temperatures at

Daguerre Point Dam actually remained at about or below 60°F during the adult immigration and holding period each of the six years (RMT 2013).

Juvenile Downstream Migration

As reported by NMFS (2007), Daguerre Point Dam may adversely affect outmigration success of juvenile salmon and steelhead. During downstream migration, juvenile Chinook salmon (and steelhead) may be disoriented or injured as they plunge over the spillway, increasing their exposure and vulnerability to predators in the large pool at the base of the dam (NMFS 2007).

NMFS (2007) and other documents (NMFS 2002; CALFED and YCWA 2005) suggest that juvenile salmonids may be adversely affected by Daguerre Point Dam on their downstream migrations, because Daguerre Point Dam creates a large plunge pool at its base, which provides ambush habitat for predatory fish in an area where emigrating juvenile salmonids may be disoriented after plunging over the face of the dam into the deep pool below. The introduced predatory striped bass and American shad have been observed in this pool (CALFED and YCWA 2005). It has been suggested that the rates of predation of juvenile salmonids passing over dams in general, and Daguerre Point Dam in particular, may be unnaturally high (NMFS 2007). However, DWR and Corps (2003) stated that there is no substantial evidence of predation on emigrating juvenile salmon by warmwater fish, and that temperature and habitat conditions in the lower Yuba River are not conducive to the establishment of significant populations of such fish, except perhaps in the Marysville area. Daguerre Point Dam may influence predation rates on emigrant juvenile anadromous salmonids, although DWR and Corps (2003) stated that there are no data indicating that such predation is significant, whether predation at the dam is offset by lower predation rates downstream, or even what percentage of juvenile salmonids are taken by predators. Presently, there is a paucity of studies or data regarding predation rates on juvenile anadromous salmonids in the vicinity of Daguerre Point Dam or elsewhere in the lower Yuba River.

Other than the dams, there are no known physical obstructions or passage barriers for adult upstream migrating Chinook salmon, or downstream migrating juvenile Chinook salmon in the lower Yuba River.

Although areas of EFH downstream of the lower Yuba River are not anticipated to be affected by the Proposed Action, the waterways (i.e., Feather and Sacramento rivers, Delta) discussed below are included for completeness in characterizing Pacific Coast salmon EFH in the region.

6.4.2.2 Feather River

For the purposes of this Applicant-Prepared Draft EFH assessment, EFH in the Feather River reach extending from the confluence of the Yuba River downstream to the confluence of the Sacramento River has the remote potential to be affected by the Proposed Action. However, it is not anticipated that substantial changes in lower Yuba River flows would occur under the Project, so changes in aquatic habitat conditions downstream of the mouth of the lower Yuba River would not be expected to occur.

EFH in this reach of the lower Feather River is primarily used as a migration corridor by adult and juvenile Chinook salmon. As previously discussed, it is not anticipated that direct or indirect effects would occur to managed species or EFH downstream of the mouth of the lower Yuba River (e.g., in the lower Feather River or Sacramento River). Because SWP operations control relatively large flows in the lower Feather River, which is a larger river than the Yuba River, even if measurable changes to flows in the lower Yuba River were to occur, it would not be practicable to attempt to segregate potential changes in lower Feather River flow downstream of the lower Yuba River associated with potential changes in lower Yuba River outflow (see Chapter 4 of the Applicant-Prepared Draft BA for further discussion).

6.4.2.3 Sacramento River

EFH in the lower Sacramento River is primarily used as a migration corridor by both adult and juvenile Chinook salmon. For the purposes of this EFH assessment, only EFH in the Sacramento River extending from the confluence of the Feather River downstream to the Delta would have a remote potential to be affected by the Proposed Action. However, it is not anticipated that substantial changes in lower Yuba River flows would occur under the Project, so changes in aquatic habitat conditions downstream of the mouth of the lower Yuba River would not be expected to occur. Moreover, because CVP/SWP operations control relatively large flows in the lower Feather and Sacramento rivers, even if measurable changes to flows in the lower Yuba River were to occur, it would not be practicable to attempt to segregate potential changes in lower Feather and Sacramento river flows downstream of the lower Yuba River (see Chapter 4 of the Draft BA for further discussion).

6.4.2.4 Sacramento-San Joaquin Delta

Estuaries are important migration habitat for adult and juvenile Chinook salmon (PFMC 2011). Although lower Yuba River adult and juvenile Chinook salmon would utilize EFH in the Delta during migration and juvenile rearing, the Proposed Action will not affect EFH in the Delta.

6.4.3 Spawning and Embryo Incubation Habitat

As described in NMFS and PFMC (2011), spawning habitat is an HAPC that has an extremely high ecological importance, and it is especially sensitive to stress and degradation by a number of land- and water-use activities that affect the quality, quantity and stability of spawning habitat (e.g., water withdrawals, sediment deposition from land disturbance, streambank armoring) (ISG 2000; SRSRB 2006). Salmon spawning habitat is typically defined as low gradient stream reaches (<3%), containing clean gravel with low levels of fine sediment and high inter-gravel flow (NMFS and PFMC 2011). All salmon require cold, highly oxygenated, flowing water as suitable spawning habitat. Spawning habitat consists of the combination of gravel, depth, flow, temperature, and dissolved oxygen (NMFS and PFMC 2011). Adverse effects to any of these factors can inhibit the spawning success of Chinook salmon. The availability and selection of suitable habitat leading to successful spawning can mean the difference between a successful recruitment year or a less than desirable one (NMFS and PFMC 2011).

6.4.3.1 Yuba River Watershed Upstream of Englebright Dam

6.4.3.1.1 North Yuba River (New Bullards Bar Dam Reach)

Although not specifically conducted for Chinook salmon EFH, studies on resident rainbow trout spawning habitat availability were conducted in the river reaches upstream of Englebright Reservoir that are potentially affected by the Proposed Action. Because Chinook salmon are not present upstream of Englebright Dam, the results of these studies are used to provide a general overview of spawning-related EFH that may be present in the Yuba River Watershed upstream of Englebright Dam, although it is recognized that suitable conditions for resident trout do not necessarily imply suitable conditions for Chinook salmon.

In the North Yuba River below New Bullards Bar Dam, one site (RM 0.2) was identified for sampling resident fish populations (see TM 3-8), which was subsequently found to be devoid of suitable spawning gravel for resident trout.

During 2011, 2012 and early 2013, YCWA conducted instream flow studies in six study reaches (totaling 25.9 miles) that included all river segments downstream of Project facilities that are located upstream of Englebright Reservoir. Using PHABSIM, flow-habitat relationships were developed for four target fish species, including the spawning, juvenile and adult lifestages of rainbow trout. Weighted usable area (WUA) results present the relationship between discharge and the availability of suitable habitat for target species (e.g., rainbow trout). Rainbow trout spawning WUA was limited in most study reaches due to patchy and limited distribution of suitable spawning substrate. Where suitable substrate was recorded, the preferred combination of depths and velocities were often not present. Rainbow trout juvenile and adult WUA functions were consistent in magnitude and discharge between study sub-reaches, increasing as channel size increased. The only exception was on the North Yuba River downstream of New Bullards Bar Dam. In this reach, simulated maximum adult rainbow trout WUA occurred at 600 cfs. Maximum spawning WUA for rainbow trout in the New Bullards Bar Dam reach was calculated to correspond to a discharge of 120 cfs.

Monitoring results during the months of October, November and December indicate that water temperatures were highest during October of the 2009 through 2012 sampling period, and maximum average daily water temperatures in the North Yuba River upstream of the Middle Yuba River during October ranged from 56.5°F (13.6°C) during 2009 up to 63.0°F (17.2°C) during 2011.

6.4.3.1.2 Middle Yuba River (with Emphasis on the ~1.5 Miles of EFH Upstream from the Confluence of the Middle Yuba River and the North Yuba River)

Several sites were identified for sampling resident fish populations in the Middle Yuba River (see TM 3-8) and include: (1) two sites in the Our House Diversion Dam Reach at RM 12.5 and 5.0; and (2) two sites downstream of the confluence with Oregon Creek on the Middle Yuba River at RM 3.3 (downstream of Moonshine Creek) and at RM 1.0 (downstream of Yellowjacket Creek).

- At the RM 12.5 site, approximately 20 and 29 square feet of gravel suitable for resident trout were observed in 2012 and 2013, respectively.
- At the RM 5.0 site, approximately 12 square feet of gravel suitable for spawning resident trout was observed in 2012, whereas none were documented in 2013.
- At the RM 3.3 site, approximately 200 square feet of suitable spawning gravel for resident trout was observed in 2012, but was not documented in 2013.
- At the RM 1.0 site, suitable spawning gravel for resident trout was not observed in 2012, but 200 square feet of gravel was documented in 2013.

Rainbow trout spawning WUA was limited in most reaches due to patchy and limited distribution of suitable spawning substrate. Where suitable substrate was recorded, the preferred combination of depths and velocities were often not present. Optimal spawning discharges varied significantly between streams and in some cases, between sub-reaches. In the Middle Yuba River, maximum spawning WUA downstream of Our House Diversion Dam was 90 cfs, whereas maximum spawning WUA downstream of the Oregon Creek confluence was 345 cfs. Upon further review, it was determined that much of the available spawning gravel downstream of the Oregon Creek confluence was perched (i.e., on the stream margin and/or out of the wetted channel at the high flow calibration measurements of 327 and 345 cfs) and was deposited during high flow events. Therefore, the perched gravels only become suitable when flows are high enough to inundate them.

Monitoring results during the months of October, November and December indicate that water temperatures were highest during October of the 2009 through 2012 sampling period, and maximum average daily water temperatures in the Middle Yuba River upstream of the North Yuba River during October ranged from 59.4°F (15.2°C) during 2010 up to 64.9°F (18.3°C) during 2011.

6.4.3.1.3 Yuba River Upstream of Englebright Reservoir

YCWA's Study 3.8 included sampling resident fish populations at two sites on the Yuba River upstream of New Colgate Powerhouse: (1) at RM 39.6, below the confluence of Middle Yuba and North Yuba rivers; and (2) at RM 35.0, upstream of New Colgate Powerhouse. Study 3.8 also included sampling fish populations at one site (RM 33.7) on the Yuba River between New Colgate Powerhouse and Englebright Reservoir.

- The site at RM 39.6 was devoid of suitable spawning gravel for resident trout during 2012 and 2013.
- At the RM 35.0 site, approximately 10 square feet of suitable resident trout spawning gravel was identified during 2012, and slightly more (50 square feet) was identified during 2013.
- At the RM 33.7 site, approximately 83 square feet of suitable spawning gravel for resident trout was identified during 2012, whereas a greater amount (225 square feet) was documented during 2013.

Rainbow trout spawning WUA was limited in most reaches due to patchy and limited distribution of suitable spawning substrate. Where suitable substrate was recorded, the preferred combination of depths and velocities were often not present. The maximum adult rainbow trout WUA was identified as 160 cfs upstream and 482 cfs downstream of New Colgate Powerhouse, respectively. Maximum spawning WUA for rainbow trout in the Middle/North Yuba River reach was calculated to correspond to a discharge of 70 cfs. In the New Colgate Powerhouse reach of the Yuba River upstream of Englebright Reservoir, the maximum spawning WUA for rainbow trout was calculated to correspond to a discharge of 253 cfs.

In the Yuba River upstream of Englebright Reservoir, monitoring results during the months of October, November and December indicate that water temperatures were highest during October of the 2009 through 2012 sampling period, and daily average water temperatures were higher in the reach located between the confluence of the North Yuba River and Middle Yuba River and upstream of New Colgate Powerhouse. Maximum average daily water temperatures in the Yuba River downstream of the confluence of the North Yuba River and Middle Yuba River during October ranged from 57.7°F (14.3°C) during 2010 up to 64.6°F (18.1°C) during 2011. Maximum average daily water temperatures in the Yuba River upstream of New Colgate Powerhouse during October ranged from 60.8°F (16.0°C) during 2010 up to 66.6°F (19.2°C) during 2011.

6.4.3.2 Downstream of Englebright Dam

6.4.3.2.1 Lower Yuba River

Spawning Physical Habitat Overview

According to Pasternack (2010), no known records of conditions prior to placer gold mining in the mid-nineteenth century are available that describe the hydrologic conditions in the river reach of the canyon where Englebright Dam and Reservoir are located. During the era of placer gold mining, Malay Camp on the northern bank of the lower Yuba River near the confluence of Deer Creek served as a base of operations for miners working Landers Bar, an alluvial deposit in the nearby canyon. The historical records of the existence of this camp and placer-mining site proves that coarse sediment was stored in the canyon prior to hydraulic mining in a large enough quantity to produce emergent alluvial bars (Pasternack 2010).

During the period of hydraulic gold mining, vast quantities of sand, gravel, and cobble entered the Yuba River (Gilbert 1917) and deposited throughout the system. This human impact completely transformed the river. Historical photos from 1909 and 1937 document that the canyon was filled with alluvial sediment with an assemblage of river features including riffles (Pasternack et al. 2010). Conditions downstream of the canyon during that period were described by James et al. (2009). Even though Daguerre Point Dam was built on the valley floor to prevent the transport of hydraulic mining debris in 1906, it is too small to block sediment migration during floods (Pasternack 2010).

Following the construction of Englebright Dam, historic photographs show that the amount of alluvium in the entire lower Yuba River, including the canyon, decreased (Pasternack et al. 2010). At the Marysville gaging station, the river incised about 20 feet from 1905-1979, while

0.5 miles downstream of the Highway 20 Bridge it incised about 35 feet over the same period (Beak Consultants, Inc., 1989). Landform adjustments continue to occur - as illustrated by Pasternack (2008), who estimated that about 605,000 yds^3 of sediment (primarily gravel and cobble) were exported out of Timbuctoo Bend from 1999 to 2006. Further investigations of landform and sediment-storage changes are on-going.

The reported changes conform with the expected, natural response of a river to blockage of downstream sediment passage (e.g. Williams and Wolman 1984). For most rivers, such geomorphic changes represent a harmful human impact on a river, but here, where there is a pre-existing, unnatural condition of the river corridor influenced by mining debris, the dam is actually contributing to the restoration of the river toward its historical geomorphic condition, in the truest meaning of the term - going back to the pre-existing state prior to hydraulic gold mining (Pasternack 2010).

On the lower Yuba River, there is strong evidence that Englebright Dam has helped to evacuate sediment without harming important channel processes (Pasternack 2010). For example, despite evidence that Timbuctoo Bend is undergoing significant sediment export and river-corridor incision, White et al. (2010) reported that eight riffles persisted in the same locations over the last 26 years, and possibly longer. Most of these persistent riffles are positioned in the locally wide areas in the valley, while intervening pools are located at valley constrictions. Thus, incision and sediment export do not necessarily translate into harmful degradation of fluvial landforms. At Timbuctoo Bend, the existence of undular valley walls preserves riffle-pool morphology in the face of on-going geomorphic change. Given the vast quantity of waste material still present in the upper system and the ability of many unhealed hillsides to generate more, Englebright Dam continues to serve as an important protection for the environment of the lower Yuba River (Pasternack 2010).

Confounding the natural response of the river to the potentially restorative impact of Englebright Dam, the lower Yuba River has been subjected to harmful in-channel human activities that further altered it. The greatest impact came from dredgers processing and re-processing most of the alluvium in the river valley in the search for residual gold and to control the river (James et al. 2009). First, there was the formation of the approximately 10,000-acre Yuba Goldfields in the ancestral migration belt. Subsequently, there was the relocation of the river to the Yuba Goldfield's northern edge and its isolation from most of the Goldfields by large "gravel berms" of piled-up dredger spoils. Dredger-spoil gravel berms also exist further upstream in Timbuctoo Bend off the Yuba Goldfields; these berms provide no flood-control benefit (Pasternack 2010).

Although no gravel berms exist in the canyon downstream of Englebright Dam, mechanized gold mining facilitated by bulldozers beginning in about 1960 completely reworked the alluvial deposits in the vicinity of the confluence with Deer Creek, changing the lower Yuba River geomorphology (Pasternack et al. 2010). Prior to mechanized mining, glide-riffle transitions were gradual, enabling fish to select among a diverse range of local hydraulic conditions. Bulldozer debris constricted the channel significantly, induced abrupt hydraulic transitioning, and caused the main riffle at the apex of the bar to degrade into a chute. In addition, mining operations evacuated the majority of alluvium at the mouth of Deer Creek, and the 1997 flood caused angular hillside rocks and "shot rock" debris from the canyon bottom to be deposited on top of the hydraulic-mining alluvium in the canyon (Pasternack 2010).

Presently, the lower Yuba River downstream of Englebright Dam continues to change in response to the complex assemblage of natural processes and human impacts. The legacy of hydraulic mining is the first and foremost impact to the system. Englebright Dam blocks further impacts from upstream mining debris, and is directing the river on a trajectory toward restoration of the pre-existing landform (Pasternack 2010). Daguerre Point Dam serves as a stabilizer in the system, providing a base level for the extent of incision between Daguerre Point and Englebright dams. Mechanized re-working of alluvium and associated channelization have dictated the lateral bounds of the river, and also impact the diversity and distribution of river-corridor landforms. The fluvial geomorphology of the Yuba River is so unique that it is crucial to evaluate it on its own terms and not to apply simple generalizations and concepts from other rivers with dams (Pasternack 2010).

Overall, gravel for spawning anadromous salmonids does not appear to be limiting in the lower Yuba River. According to the RMT (2013), spawning habitat does not appear to be limited by an inadequate supply of gravel in the lower Yuba River due to ample storage of mining sediments in the banks, bars, and dredger-spoil gravel berms (RMT 2013). Beak Consultants, Inc (1989) stated…"*The spawning gravel resources in the river are considered to be excellent based on the abundance of suitable gravels, particularly in the Garcia Gravel Pit and Daguerre Point Dam reaches. The tremendous volumes of gravel remaining in the river as a result of hydraulic mining make it unlikely that spawning gravel will be in short supply in the foreseeable future. Armoring of the channel bed is possible, but has not developed to date, probably due to periodic flushing by floods comparable to the 1986 event*."

Similarly, Pasternack (2008) reported that…In Timbuctoo Bend "…*there is adequate physical habitat to support spawning of Chinook salmon and steelhead trout in their present population size. Furthermore, all of the preferred morphological units in the [Timbuctoo Bend Reach] TBR have a lot of unutilized area and adequate substrates to serve larger populations*."

Farther downstream, spawning habitat does not appear to be limited by an inadequate supply of gravel within the Parks Bar and Hammon Bar reach of the lower Yuba River due to ample storage of mining sediments in the banks, bars, and dredger-spoil gravel berms (cbec and McBain & Trush 2010).

As reported by the RMT (2013), the overall mean substrate diameter (Dmean) within the bankfull channel is 97.4 mm. On the lower Yuba River salmonids tend to spawn in mean substrate sizes ranging from about 50-150 mm. The average Dmean at each cross-section was calculated and plotted as a longitudinal distribution (Figure 6.4.3-1). This analysis shows that most of the channel is characterized by average Dmean values within the acceptable spawning substrate size. The exceptions are sand/silt areas near the confluence of the Feather River and the boulder/bedrock regions in the upper sections of Timbuctoo Bend and most of Englebright Dam reaches.

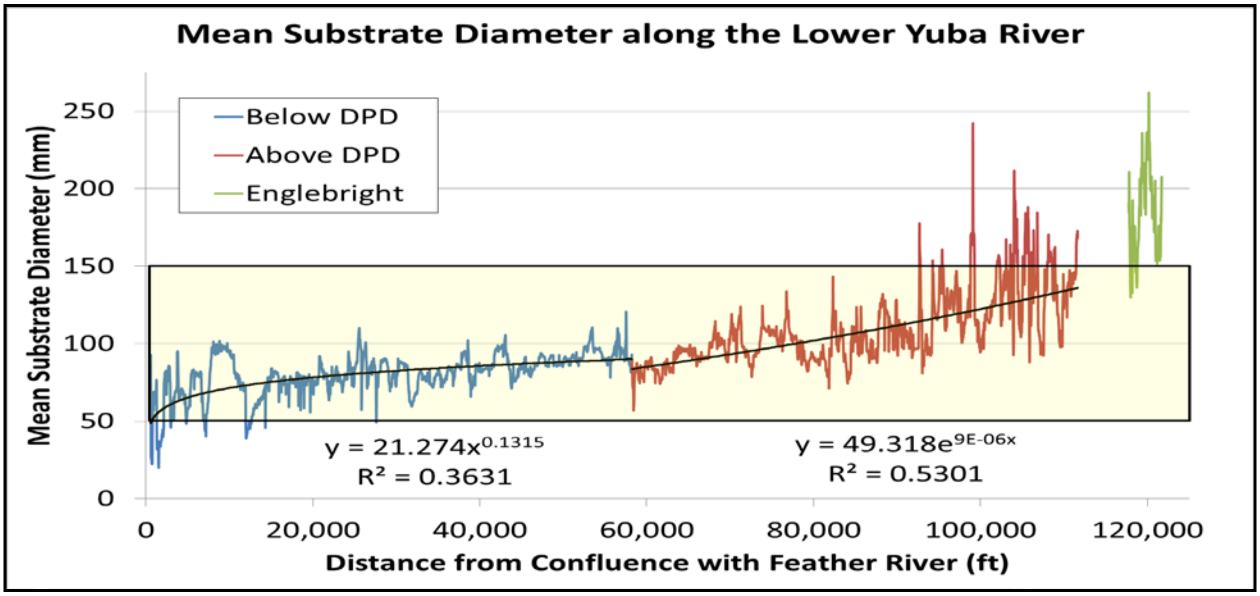

Figure 6.4.3-1. Longitudinal distribution of the mean substrate diameter. The box represents the typical range of spawning substrate sizes observed on the lower Yuba River.

Gravel Augmentation

The Corps has been injecting a mixture of coarse sediment in the gravel (2-64 mm) and cobble (64-256 mm) size ranges into the Englebright Dam Reach, as part of their voluntary conservation measures associated with ESA consultations regarding Daguerre Point Dam. Four separate gravel injection efforts have been undertaken from 2007-2013, with approximately 15,500 tons of gravel/cobble placed into the Englebright Dam Reach.

Future gravel injections are anticipated as one of the Corps voluntary conservation measures. The Corps' Gravel Augmentation Implementation Plan (GAIP) provides guidance for a long-term gravel injection program to provide Chinook salmon spawning habitat in the bedrock canyon downstream of Englebright Dam. The Corps has contracted bathymetric survey monitoring to compare volumetric differences between pre- and post- gravel injection distributions, to further evaluate the disposition of the injected gravels. Additionally, the Corps has funded PSMFC to conduct redd surveys in the Englebright Dam Reach to investigate whether Chinook salmon and steelhead are utilizing areas where gravel placement occurred.

The GAIP (Pasternack 2010) describes present and proposed future gravel injection efforts, based on information available in 2010. The long-term plan calls for continuing gravel/cobble injection into the Englebright Dam Reach until the estimated coarse sediment storage deficit for the reach is eradicated, and then it calls for subsequent injections as needed to maintain the sediment storage volume in the event that floods export material downstream of the reach. The Corps does not currently have the authority to completely eradicate the deficit created by various causes in one placement, nor is that the intent of the Corps gravel injection program (Corps 2013). For more detailed discussion of physical habitat conditions for spawning Chinook salmon in the lower Yuba River, refer to Chapter 6 of the Draft BA prepared for the Proposed Action.

Chinook Salmon Spawning Carrying Capacity in the lower Yuba River

Carrying capacity of a river can be estimated using estimates of suitable habitat area and area of habitat being utilized. At a flow of 600 cfs, the total area of the lower Yuba River with CHSI greater than 0.4 is about 6.6 million ft^2 (~600,000 m^2). This area of potentially suitable Chinook salmon spawning habitat is larger than the Chinook salmon spawning WUA index because it is based on the assumption that any given area with a CHSI > 0.4 represents suitable spawning habitat, with no weighting based on the CHSI value. The use of a CHSI > 0.4 as a threshold to distinguish potentially suitable spawning habitat is based upon the extensive bio-verification analyses conducted for the RMT predictive spawning model. While the area that an individual Chinook salmon redd requires varies among reports, the RMT's intensive redd pilot study in 2008 found that the mean Chinook salmon redd size was 59.7 ft^2, which is consistent with the range of values from other published studies. In addition, a nearly equal amount of occupied and unoccupied area within a cluster of observed redds was typically observed (i.e., one redd every 119.5 ft^2). If one redd was assumed to require an area of 119.5 ft^2, the lower Yuba River would be able to support up to a maximum of approximately 55,000 redds. The mean Chinook salmon redd size during the RMT's 2009 and 2010 Chinook salmon redd surveys was approximately 67 and 73 ft^2, respectively. Calculating the estimated carrying capacity using twice the largest mean redd size of 73 ft^2 results in an estimation of about 45,000 Chinook salmon redds, greatly exceeding the number of Chinook salmon redds observed during the 2009 and 2010 near-census redd surveys (approximately 3,300 and 3,100, respectively). For further discussion of physical habitat conditions in the lower Yuba River, refer to Pasternack et al. (2013).

Chinook Salmon Spawning Habitat Availability

This section evaluates Chinook salmon spawning habitat availability (WUA) under existing conditions (i.e., the Environmental Baseline or Base Case scenario) using simulated hydrologic conditions, compared to "Without-Project" hydrologic conditions. The following evaluations utilize the same methodology employed in the Draft BA for spring-run Chinook salmon, modified to represent the timing and geographic location for fall-run Chinook salmon, as applicable. For consistency with the Draft BA, existing conditions for this EFH assessment also are referred to as "Environmental Baseline". Modeling was conducted using a water balance/operations model to simulate operations of YCWA's Project. The Project water balance/operations model (model) simulates Project operations on a daily timestep. Flow-dependent habitat assessments were modeled using the 41-year operational evaluation period extending from water year (WY) 1970 through 2010. For a detailed description of the model, see Technical Memorandum 2-2.

The existing conditions scenario represents conditions as they currently exist, with the current rules, regulations, water supply demands, and operational practices. The existing conditions scenario includes a representation of the regulatory requirements affecting Project operations, including the Yuba Accord instream flow requirements and flow schedules. The existing conditions scenario also includes a representation of current agricultural irrigation demands served by the Project, and hydrology that results from the current operations of facilities owned and operated by others upstream from the Project. Lastly, the existing conditions scenario includes a representation of Project operational practices such as New Bullards Bar Reservoir

Target Operating Line operations, New Bullards Bar Reservoir carryover storage operations, New Colgate Powerhouse operations, and Englebright Reservoir operations – all of which are current operating practices in the watershed.

The "Without-Project" scenario represents mean daily flows and water temperatures in the lower Yuba River as if Project facilities and operations did not exist, but with all other water projects in the Upper Yuba River Basin operating. Measured inflows and synthesized accretions used in the Without-Project hydrology are used as inputs to the operations model. The Without-Project scenario also is simulated by the operations model to estimate mean daily flows in the lower Yuba River for 41 years (WY 1970 through WY 2010).

Calculation of Chinook salmon spawning WUA was generally conducted using the methodology applied in Technical Memorandum 7-10, including procedures detailed in Pasternack (2011). Spawning WUA for Chinook salmon was evaluated only for simulated flows up to 5,000 cfs at the Smartsville Gage, which generally represents the bankfull flow in the lower Yuba River. Because no substrate mapping has been conducted for the overbank region, there is no way to identify suitable substrates using the RMT's substrate HSCs. There is unmapped low-density grass and woody debris scattered throughout the overbank region, and studies have found that salmonids do not spawn on submerged aquatic vegetation (Elkins et al. 2007), so it is not expected that they would spawn on grass or debris.

Because flows do not exceed 5,000 cfs over the 41-year simulation period during the September through mid-October spring-run Chinook salmon spawning period, no simulated daily flows were excluded from the spring-run Chinook salmon spawning WUA analysis. During the October through December fall-run Chinook salmon spawning period, flows exceed 5,000 cfs during about 3 percent of the days over the 41-year simulation period, which were excluded from the fall-run Chinook salmon spawning WUA analysis.

Because the WUA-discharge relationships are static and do not represent how often a specific habitat-discharge relationship occurs, habitat duration analyses (or probability of exceedance distributions) were conducted using the daily flow model. A habitat duration curve is constructed in exactly the same way as a flow duration curve, but uses habitat values instead of discharge as the ordered data. A habitat duration curve is computed simply by obtaining the WUA value (for each species/lifestage) that corresponds to the mean daily flow for each day in the hydrologic record. The product is the mean daily habitat for each day in the hydrologic record. These data are then ordered into what is referred to as a habitat duration (or probability of exceedance) curve showing the percent time a particular habitat value is equaled or exceeded. Habitat duration analyses were conducted for the period extending from September 1 through October 15 for spring-run Chinook salmon spawning, and from October through December for fall-run Chinook salmon spawning. In addition, based on adult spring-run Chinook salmon acoustic tagging studies, Chinook salmon carcass surveys, and Chinook salmon surveys (RMT 2013), the spring-run Chinook salmon spawning habitat analyses conducted for this EFH assessment are restricted to upstream of Daguerre Point Dam, because virtually all spring-run Chinook salmon spawning occurs upstream of Daguerre Point Dam. Spawning habitat analyses for fall-run Chinook salmon are conducted for both upstream and downstream of Daguerre Point Dam in the lower Yuba River.

For the spawning habitat analyses, spawning habitat availability (WUA) is expressed as percent of maximum availability (WUA). Comparisons were made between the existing conditions scenario (i.e., Environmental Baseline) and the "Without-Project" scenario. Percent of maximum WUA is presented for each scenario as a long-term average, and average by water year types. In addition, the two scenarios are compared using the metric of percent of maximum WUA as exceedance distributions for the habitat duration analyses.

The RMT evaluated Chinook salmon spawning habitat suitability and availability in the lower Yuba River with the use of microhabitat suitability prediction modeling, and development of associated reach-specific Chinook salmon spawning WUA-discharge relationships. Information on Chinook salmon spawning in the lower Yuba River, including Chinook salmon spawning microhabitat suitability prediction, and spawning habitat-discharge relationships is summarized in the Draft BA prepared for the Proposed Action, and is not repeated here.

Modeled Spring-run Chinook Salmon Spawning Habitat Availability

Table 6.4.3-1 displays the long-term average and average by water year type spring-run Chinook salmon spawning WUA (percent of maximum) under the Environmental Baseline and Without-Project scenarios. Over the entire 41-year simulation period, long-term average spring-run Chinook salmon spawning habitat availability (WUA) in the lower Yuba River is slightly higher under the Environmental Baseline relative to the Without-Project scenario (long-term average of 94.5 percent versus 92.2 percent of the maximum WUA). The Environmental Baseline results in 3.9 percent less maximum spawning habitat during wet water years, 0.5 percent more during above normal water years, and 3.2 percent more during below normal water years. The Environmental Baseline provides substantially more spring-run Chinook salmon spawning habitat (expressed as percent of maximum WUA) than the Without-Project scenario during dry water years (7.2%), and during critical water years (10.9%). The Environmental Baseline provides over 90 percent of maximum spawning WUA during all water year types, whereas the Without-Project scenario does not provide 90 percent or more of maximum spawning WUA during dry or critical water year types.

Table 6.4.3-1. Long-term and Water Year Type Average Spring-run Chinook Salmon Spawning WUA (Percent of Maximum) under the Environmental Baseline and Without Project Scenarios.

Scenario	Long-term Full Simulation Period[2]	Water Year Types[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Environmental Baseline	94.5	92.8	94.5	95.4	96.0	96.1
Without Project	92.2	96.7	94.0	92.2	88.8	85.2
Difference	2.4	-3.9	0.5	3.2	7.2	10.9

[1] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

Habitat duration for spring-run Chinook salmon spawning under the Environmental Baseline and Without-Project scenarios are presented in Figure 6.4.3-2. The Environmental Baseline provides substantively greater amounts of spawning habitat availability over about the lowest 50 percent of the exceedance probability distribution. Also, the Environmental Baseline achieves over 90 percent of maximum spawning WUA with about an 87 percent probability, by contrast to the Without-Project scenario which achieves over 90 percent of maximum spawning WUA with about a 60 percent probability.

Modeled Fall-run Chinook Salmon Spawning Habitat Availability

Table 6.4.3-2 displays the long-term average and average by water year type fall-run Chinook salmon spawning WUA (percent of maximum) under the Environmental Baseline and Without-Project scenarios. Over the entire 41-year simulation period, long-term average fall-run Chinook salmon spawning habitat availability (WUA) in the lower Yuba River is substantially higher under the Environmental Baseline relative to the Without-Project scenario (long-term average of 93.3 percent versus 81.5 percent of the maximum WUA). The Environmental Baseline results in 9.6 percent more maximum spawning habitat during wet water years, 13.5 percent more during above normal water years, 12.2 percent more during below normal water years, 13.0 percent more during dry years, and 13.3 percent more during critical water years. The Environmental Baseline provides over 90 percent of maximum spawning WUA during all water year types except for during wet water years (89.2%), whereas the Without-Project scenario does not provide 90 percent or more of maximum spawning WUA during any water year type.

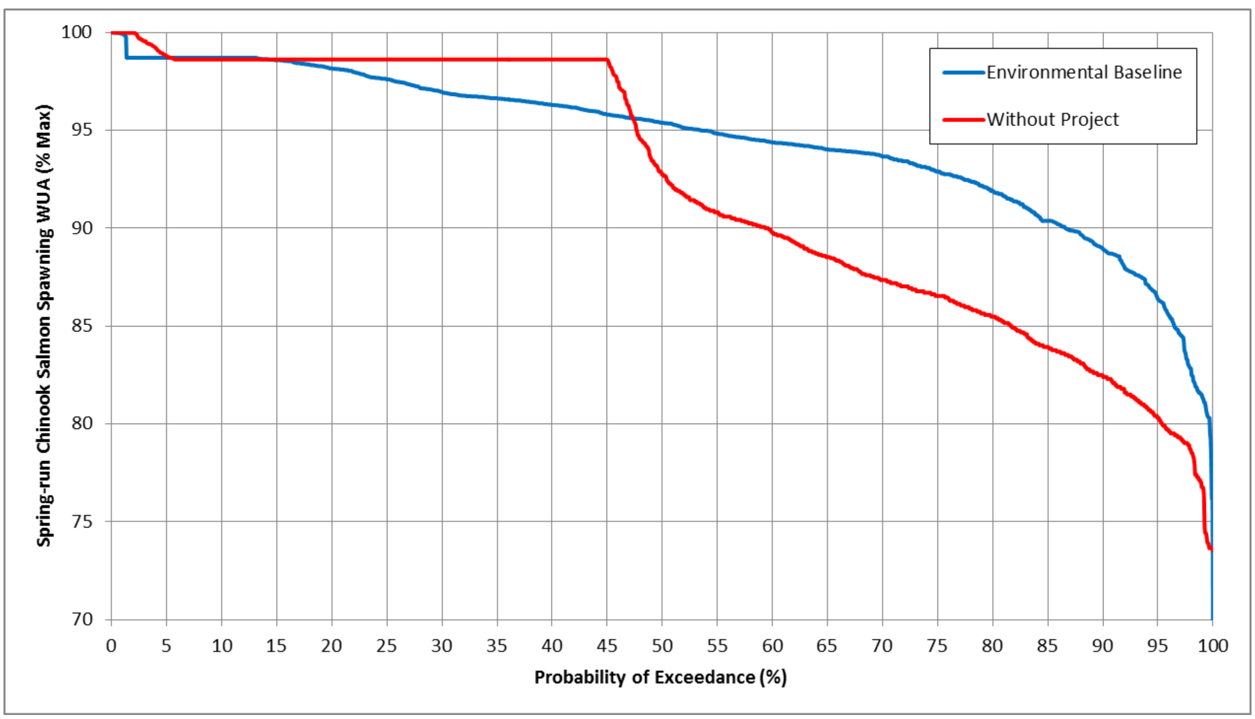

Figure 6.4.3-2. Spring-run Chinook salmon spawning habitat duration over the 41-year hydrologic period for the Environmental Baseline and Without-Project scenarios.

Table 6.4.3-2. Long-term and Water Year Type Average Fall-run Chinook Salmon Spawning WUA (Percent of Maximum) under the Environmental Baseline and Without Project Scenarios.

Scenario	Long-term Full Simulation Period[2]	Water Year Types[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Environmental Baseline	93.3	89.2	94.5	93.4	96.2	97.0
Without-Project	81.5	79.6	81.0	81.2	83.2	83.7
Difference	11.8	9.6	13.5	12.2	13.0	13.3

[1] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

Habitat duration for fall-run Chinook salmon spawning under the Environmental Baseline and Without-Project scenarios are presented in Figure 6.4.3-3. The Environmental Baseline provides substantively greater amounts of spawning habitat availability over about the lowest 70 percent of the exceedance probability distribution. Also, the Environmental Baseline achieves over 90 percent of maximum spawning WUA with about an 87 percent probability, by contrast to the Without-Project scenario which achieves over 90 percent of maximum spawning WUA with about a 44 percent probability.

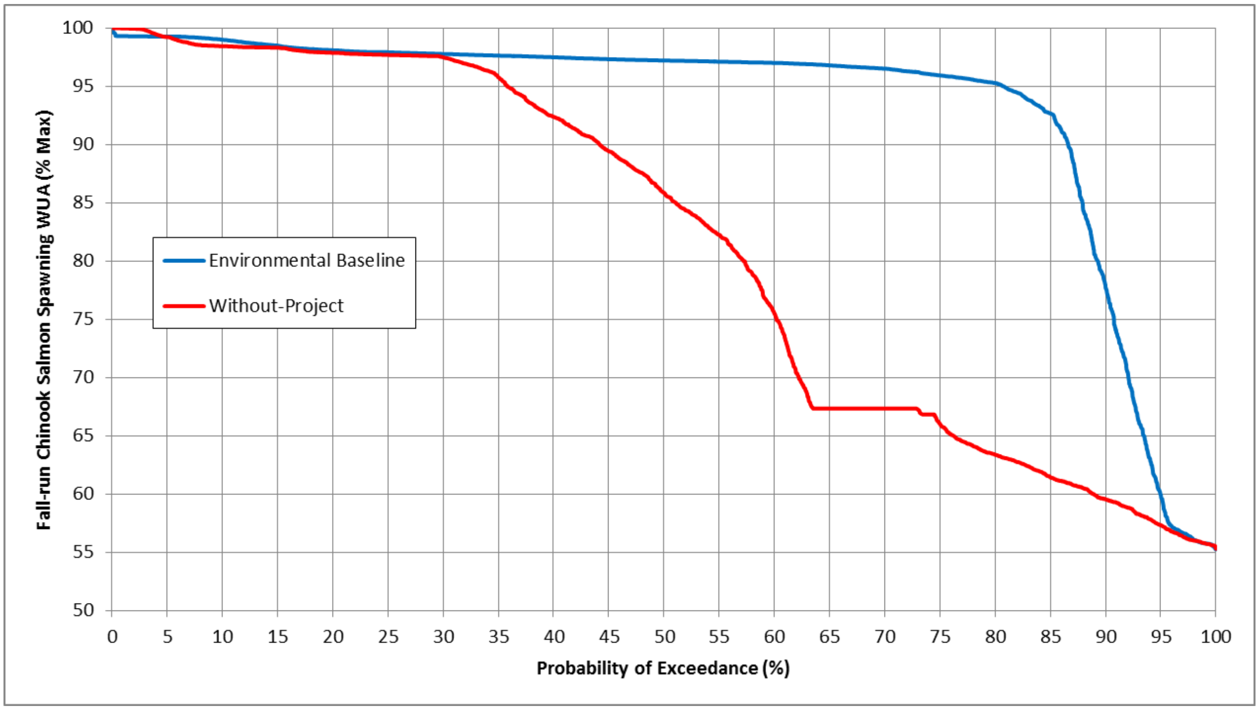

Figure 6.4.3-3. Fall-run Chinook salmon spawning habitat duration over the 41-year hydrologic period for the Environmental Baseline and Without-Project scenarios.

6.4.3.2.2 Water Temperature

The upper tolerance WTI value of 58°F was developed by the RMT (2013) to evaluate both the spawning and embryo incubation lifestages for Chinook salmon because these lifestages are closely linked temporally, and studies describing how water temperature affects embryonic survival and development based on varying water temperature treatments on holding adults often report similar results to water temperature experiments conducted on fertilized eggs. The value of 58°F was selected by RMT (2013) because: (1) upper value of the range given for preferred water temperatures (i.e., 53°F to 58°F) for eggs and fry (NMFS 2002a); (2) constant egg incubation temperatures between 42.5°F and 57.5°F resulted in normal development (Combs and Burrows 1957); and (3) the natural rate of mortality for alevins occurs at 58°F or less (Reclamation Unpublished Work).

Evaluation of the spring-run Chinook salmon and fall-run Chinook salmon spawning and embryo incubation upper tolerance WTI value in the lower Yuba River was conducted using simulated water temperatures under existing conditions (i.e., the Environmental Baseline) and the Without-Project scenario. In summary, monitored and modeled water temperatures are generally suitable during the spring-run and fall-run Chinook salmon spawning and embryo incubation periods, with the exception of early October of the fall-run Chinook salmon spawning and embryo incubation lifestages under existing conditions. Simulated water temperatures under existing conditions are substantially more suitable for all Chinook salmon lifestages relative to the Without-Project scenario.

6.4.4 Juvenile Rearing Habitat

The abundance of in-river juvenile Chinook salmon is a function of many factors, including abundance of newly emerged fry, quantity and quality of suitable habitat, abundance and composition of food, and interactions with other fish, birds and mammals (Bjornn and Reiser 1991). HAPCs associated with juvenile Chinook salmon rearing complex channels and floodplain habitats, as well as thermal refugia.

6.4.4.1 Complex Channels and Floodplain Habitats

In general, complex channels and floodplain habitats, including wetlands, oxbows, side channels, and steeper, more constrained channels with high levels of LWM, provide valuable habitat for all Pacific salmon species (NMFS and PFMC 2011). The density of rearing salmon is reported to be greatest in areas of high quality naturally functioning floodplain habitat and in areas with large woody material (LWM), rather than in anthropogenically modified floodplains (Brown and Hartman 1988; Montgomery et al. 1999). Complex floodplain habitats are dynamic systems that change over time, and the habitat-forming processes that create and maintain these habitats (e.g., erosion, channel avulsion, input of large wood) should be considered as integral to the habitat (NMFS and PFMC 2011).

LWM is generally considered to be an important component of these habitats, and typically occurs in the form of logjams in floodplains and larger rivers (NMFS and PFMC 2011). LWM helps to create complex channels and floodplain habitats and important spawning and rearing habitat by trapping sediment, nutrients, and organic matter, creating pools, sorting gravels, providing cover and hydrologic heterogeneity, and creating important spawning and rearing areas for salmon (Abbe and Montgomery 1996; Bilby and Bisson 1998). These areas also provide pools, off-channel areas, shade, cooler temperatures, and thermal refugia during both summer and winter (Crispin et al. 1993).

In most river systems throughout California, complex floodplain habitats have been subject to a high degree of direct anthropogenic modification. Floodplain areas have been cleared of woodland vegetation, drained, and filled to allow agricultural, residential, and urban development (Pess et al. 2002). Channelization and diking of rivers has effectively separated rivers from many off-channel habitats once available to salmonids (Reeves et al. 1998 as cited in NMFS and PFMC 2011). Clearing of large wood accumulations in rivers was commonplace to both improve navigation and facilitate transport of logs from upstream forest to mill sites downstream (Bilby and Bisson 1998).

Low-gradient, unconstrained reaches that typify where complex floodplain habitats are expressed are also highly responsive to disturbances that happen higher up in the watershed (NMFS and PFMC 2011). For example, sediments generated by land-use practices are typically routed through higher gradient, transport reaches and are deposited in low-gradient reaches. This can lead to widening and shallowing of the river channel, filling in of pool habitats, and reductions in the average particle size of the substrate (Montgomery and Buffington 1998). These changes, in turn, diminish the quality of spawning and rearing habitats for salmon, as well the capacity of affected reached to produce invertebrates that salmonids depend on for food (NMFS and PFMC 2011).

Historical land-use practices including logging of riparian forests and active removal of wood from the stream channel to facilitate fish passage and protect local infrastructure has fundamentally altered the structure and function of salmon habitats (NMFS and PFMC 2011). Despite improvements in forest and land management that have occurred in the last 40 to 50 years, the legacy of early practices remains apparent in diminished sources for recruitment of large wood (particularly of coniferous origin), decreased quantities of large wood in stream channels, and a shift in composition of large wood pieces from large-diameter pieces of coniferous origin to smaller diameter pieces of hardwood origin, which decompose at a much faster rate (Bilby and Bisson 1998).

Historically, neither complex floodplain habitats nor mid-gradient channels with large quantities of in-channel wood were inherently rare within forested landscapes of California, but they have become increasingly so in response to human alterations of the landscape.

6.4.4.2 Thermal Refugia

Thermal refugia are defined as areas where fish may escape high water temperatures, especially during hot, dry summers in California (NMFS and PFMC 2011). Thermal refugia provide important holding and rearing habitat for adults and juveniles (Goniea et al. 2006; Sutton 2007). Important thermal refugia often exist higher in hydrologic units and are most susceptible to blockage by artificial barriers (Yoshiyama et al. 1998). Reduced flows that are either anthropogenic, natural or climate-change induced also may reduce or eliminate access to refugia (Battin et al. 2007; Riley et al. 2009). Loss of structural elements such as large wood can also influence the formation of thermal refugia.

Thermal refugia typically include coolwater tributaries, lateral seeps, side channels, tributary junctions, deep pools, areas of groundwater upwelling and other mainstem river habitats that are cooler than surrounding waters (≥3.6°F cooler) (Torgersen et al. 1999; Ebersole et al. 2003). As such, refugia can occur at spatial scales ranging from entire tributaries (e.g., spring-fed streams), to stream reaches (e.g., alluvial reaches with high hyporheic flow), to highly localized pockets of water only a few square meters in size embedded within larger rivers (NMFS and PFMC 2011).

Studies have shown that salmon increase their use of thermal refugia (e.g., cool water tributaries) when exposed to elevated water temperatures (Sutton 2007), which can significantly reduce migration rates and suggests these areas provide crucial habitat in warm years (Goniea et al. 2006). Torgersen et al. (1999) state that the ability for coldwater fish such as salmon to persist in warmwater environments (>77°F) that experience elevated summer temperatures and seasonal low flows may be attributed to thermal refugia because even relatively minor differences in temperature are ecologically relevant for fish. In addition, climate change is expected to cause a rise in freshwater temperatures and a reduction in snowpack, which would lead to lower flows in the summer and fall (Battin et al. 2007; Mote et al. 2003; Stewart et al. 2004). These water temperature changes would likely result in a reduction in the quantity and quality of freshwater salmon habitat, making thermal refugia even more important in the future (NMFS and PFMC 2011).

The abundance of cool water habitat features can vary substantially depending upon many factors including geographic location, flow characteristics and time of year (NMFS and PFMC 2011). However, in certain areas with hot, dry summers (e.g., lower Sacramento River) it is likely that little, if any, suitable holding habitat exists for salmon to take refuge from elevated water temperatures (NMFS 2009a). Moreover, because climate change is expected to cause an increase in freshwater temperatures and prolonged summer drought periods (Battin et al. 2007; Mote et al. 2003), these habitat types can be expected to become more rare (ISAB 2007).

The lower Yuba River is unique, in that the Project provides substantial, dependable low water temperature refugia for holding, spawning and rearing of Chinook salmon, due to the release of large flows drawn from a large pool of cold water in New Bullards Bar Reservoir. The effectiveness of this temperature refugia is demonstrated by the re-establishment of anadromous salmonid populations under the existing conditions, which had previously likely been extirpated from the river under Without Project conditions.

6.4.4.3 Yuba River Watershed Upstream of Englebright Dam

6.4.4.3.1 North Yuba River (New Bullards Bar Dam Reach)

Complex Channels and Floodplain Habitats

In 2012, YCWA conducted a riparian habitat study in the Project-affected reaches upstream of the Englebright Reservoir to assess the condition of riparian habitats upstream that may be affected by the Proposed Action (see Technical Memorandum 6-1). Field efforts included surveys for riparian vegetation and LWM. All LWM that exceeded half of the average bankfull widths for each reach, exceeded 25 inches in diameter and 25 feet in length, or showed morphologic influence (e.g., trapping sediment or altering flow patterns) were considered "key" pieces. The largest size classes of LWM (i.e. longer than 50 feet and greater than 24 inches diameter) were rare or uncommon.

In general, site vegetation was limited overall due to substrate, and most vegetation was low growing and distributed amongst the boulders where a foothold was possible. Himalayan blackberry was present within most vegetation transects. Himalayan blackberry may affect the function of riparian communities because it generally does not provide significant shade for stream water and does not contribute to LWM in streams (Bennett 2006). Although Himalayan blackberry were present throughout the stream reaches, shrubs and trees of various age classes were also present, indicating that recruitment is still occurring and Himalayan blackberry has not completely displaced those species, and the function of the riparian communities does not appear to have changed, as shrubs and trees continue to provide stream shade and LWM sources. Overall, YCWA assessed the assessment area communities as healthy because there is no indication of a lack of riparian function in these areas. YCWA evaluated most stream reaches as healthy because recruits of woody vegetation and a variety of age classes were present in all stream reaches, indicating that germination is occurring under current Project operation and lateral distribution of woody species is within the expected range, with willows near the wetted edge and other hardwood species occurring farther upslope (Harris and McBride 2013).

The North Yuba River at the survey site was dominated by bedrock and large boulders, and woody species cover along vegetation transects was about 1 percent in the North Yuba River. The assessment site at the North Yuba River upstream from the confluence with the Middle Yuba River reportedly has a high potential to be affected by changes in flow patterns between With- and Without Hydrology (see TM 6-1). Summary results from TM 6-1 with respect to North Yuba River floodplain and riparian habitat conditions are provided below.

Overall, vegetation was limited, but a variety of age classes for all observed species was present in the riparian corridor. Under current Project O&M, the riparian vegetation appears healthy and hydrologically connected within the floodplain. However, changes in discharge volume, and associated periods of continuous inundation reportedly are not infrequent and can be dramatic. Field observations indicated that the majority of the woody species were willows and were present upslope of bankfull, within floodprone. The dominant substrate at transects was bedrock and boulder; substrates with limited capability to support woody vegetation (Figure 6.0-1 in Attachment 6-1D). Woody species may not be present closer to the wetted edge because supporting fines may not be present, inundation of substrate conditions may be too high or continuously long, or the velocity of high flows may prevent establishment.

LWM has the potential to influence pool formation, increase shade and collect sediment and organic litter within streambeds (Benda and Litschert 2013). Thirteen key pieces of wood were located during LWM surveys. Of these, no key pieces were located in the North Yuba River. Smaller size classes of LWM were not evenly distributed throughout the reaches surveyed, and the average volume (m^3) of LWM per 100 meters in the North Yuba River was reported to be 6.7 m^3 per 100 m average.

In the past, YCWA has annually gathered all LWM that accumulates in New Bullards Bar Reservoir, booms it together and burns it, with appropriate permits, every 1 to 3 years. Using data collected by Senter et. al. (2012), the volume of wood captured by New Bullards Bar Reservoir can be estimated for 2010 (125,000 yd^3) and 2012 (295,000 yd^3). Efforts are presently underway by the Corps to develop an accurate LWM budget for stream reaches upstream of Englebright Dam, which is expected to be available in 2013/2014. The Corps also has developed a Large Woody Material Management Program (LWMMP), which includes the implementation of a Pilot Study to enhance rearing conditions for spring-run Chinook and steelhead in the lower Yuba River (Corps 2012a). The Corps proposes to initiate a Pilot Study to determine an effective method of replenishing the supply of LWM back into the lower Yuba River. The Corps Pilot Study will use LWM from existing stockpiles at New Bullards Bar Reservoir for placement at selected sites along the lower Yuba River. A long-term LWMMP for the lower Yuba River is anticipated to occur within one year following completion of the Pilot Study, and is subject to available funding.

6.4.4.3.2 Thermal Refugia (Water Temperatures)

Monitoring results during the months of December through June indicate that maximum daily average water temperatures in the North Yuba River upstream of the Middle Yuba River would not exceed the upper tolerance WTI of 65°F for juvenile rearing and downstream movement.

Similarly, monitoring results during the year-round spring-run Chinook salmon juvenile rearing and downstream movement period suggest that maximum daily average water temperatures in the North Yuba River upstream of the Middle Yuba River would not exceed the upper tolerance WTI of 65°F for juvenile rearing and downstream movement.

6.4.4.3.3 Prey Availability (Macroinvertebrate Community Assemblages)

In 2012, YCWA conducted an aquatic macroinvertebrates study in stream reaches upstream of Englebright Reservoir that are potentially affected by the Proposed Action. YCWA and Relicensing Participants agreed to not sample two locations that were identified in the FERC-approved study: 1) the Middle Yuba River downstream of Our House Dam; and 2) the North Yuba River downstream of New Bullards Bar Reservoir. The sites were not sampled due to poor site conditions to implement the approved protocol.

A index of biotic integrity (IBI) score of 21 was found at the site in the North Yuba River upstream of the Middle Yuba River, and a multi-metric index (MMI) score of 16 was found at the survey site in the North Yuba River upstream of the Middle Yuba River. Figure 6.4.4-1 shows these scores by site, including the North Yuba River and other reaches upstream of Englebright Dam.

BMI communities in streams can be highly influenced by a variety of naturally occurring and human-induced factors, including annual hydrologic cycles, timing and magnitude of spring outflows, water temperatures, streambed substrate composition, channel gradient, bank erosion and sediment deposition, pollution, riparian habitat degradation, instream-mining, hydropower development and recreational activities. The presence of dams and diversions on streams can substantially affect the supply and mobility of streambed sediment by retention in storage reservoirs and alteration of the magnitude and timing of stream flows, which can significantly affect the abundance and distribution of BMI communities. Rehn (2009) found that BMI-based IBI metrics tend to be lowest immediately downstream of dams and diversions but normally increase with distance below these structures.

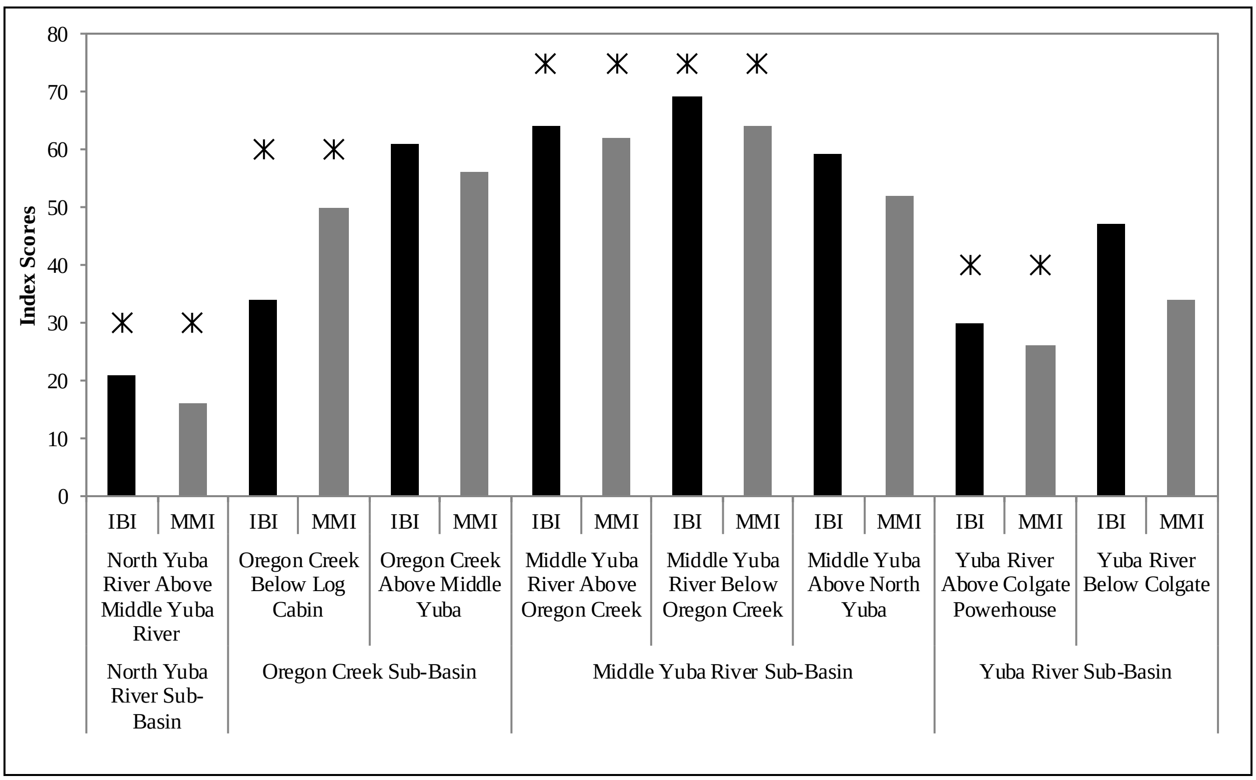

Figure 6.4.4-1. Overview of scores by basin, stream, and indices. Sites with starred symbols represent locations where insufficient organisms were collected to make the resultant IBI and MMI scores reliable.

Trends in BMI index site scores and potential interrelated factors leading to those scores were evaluated in Technical Memorandum 3-1 *Aquatic Macroinvertebrates Upstream of Englebright Reservoir*. Overall site scores from both indices found that higher quality sites (as ranked) were found further downstream, which reportedly is similar to findings by Rehn (2009). Sites below reservoirs generally show a significant difference in reduced quality. Rehn (2009) suggests that reduced quality may include lower diversity, EPT (i.e., ephemoptera, plecoptera, and trichoptera) richness, and reduced intolerant taxa and that studies showed that these issues may lessen with distance downstream. Generally, the sampling results followed these trends.

A single sample location was located in the North Yuba River Sub-basin near the confluence with the Middle Yuba River and only 2.0 miles downstream of New Bullards Bar Dam. This location had the lowest IBI and MMI scores of all the study sites. Additionally, an insufficient number of BMI were collected at the site, making the calculated IBI and MMI scores less reliable. It is likely that the low abundance of BMI and low IBI and MMI scores at this site are partially related to available habitat. Habitat at this site was dominated by pool (79%) with boulder substrates (49%). The dominance of these parameters are not ideal for high abundance and diversity of BMI populations. Another factor possibly contributing to the overall low scores was the lack of riparian vegetation. Water quality parameters were within expected ranges and did not appear to be a limiting factor to BMI.

6.4.4.3.4 Middle Yuba River (with Emphasis on the ~1.5 Miles of EFH Upstream from the Confluence of the Middle Yuba River and the North Yuba River)

As described in Technical Memorandum 6-1, the Middle Yuba River downstream of Our House Diversion Dam was dominated by cobble, large boulders, and gravel with many pools and pocket water areas. There was no evidence of channel encroachment or bank instability. The average bankfull width in the site was 73 feet and the average flood prone width was 106 feet. In general, site vegetation was diverse in species assemblage and age class. For the site as a whole, riparian vegetation was dense enough to limit walking on banks (see Figure 3.0-1 in Attachment 6-1D of Technical Memorandum 6-1). Summary results from TM 6-1 with respect to Middle Yuba River floodplain and riparian habitat conditions downstream of Our House Diversion Dam are provided below.

- **Transect 2** - Observed bankfull width was about 65 feet and flood prone width was about 100 feet. Transect 2 was comprised of cobble, boulder, and gravel to valley extent on river right, and bedrock on river left. Mature woody vegetation includes red willow (20% - 75% cover) and white alder (50% - 75% cover) on river right and left. Recruits and seedlings of red willow were recorded on river right and seedlings of red willow were recorded on river left. Upslope of floodprone, the bedrock river valley walls support little vegetation with sparse poison oak and Himalayan blackberry. Within bankfull, the bedrock river valley walls support little vegetation (see Figure 3.0-2 in Attachment 6-1D).
- **Transect 4** - Observed bankfull width was about 60 feet and flood prone width was about 80 feet. Transect 4 was comprised of a large boulders and bedrock on river right and large boulders on river left. Mature woody vegetation included white alder (up to 60% cover), red willow (20% - 80% cover), and black locust (up to 5% cover) on river right; and white alder (35% cover) mid-channel; and, white alder (65% cover) and red willow (5% cover) on river left. White alder recruits, as well as red willow and black locust seedlings were recorded mid-channel. White alder and red willow seedlings as well as

red willow recruits were recorded on river left. Upslope of bankfull, the bedrock river valley walls support little vegetation with sparse poison oak and Himalayan blackberry. Within bankfull, the bedrock river valley walls support little vegetation.

- **Transect 7** - Observed bankfull width was about 70 feet and flood prone width was about 105 feet. Transect 7 was comprised of small boulders and large cobbles with sand on river right and left with some bedrock on river left. Mature woody vegetation includes both white alder (30% - 85% cover) and cottonwood (10% cover) on river right and white alder (100% cover) on river left. Both recruits and seedlings of white alder and seedlings of red willow were recorded on river right; no recruits and seedlings were recorded on river left. Younger-looking (smaller) woody species had greater cover within bankfull, with larger trees and shrubs farther from the wetted edge. The wetted edge of the channel within bankfull on river left meets the steep bedrock bank and did not support vegetation. Upslope of bankfull, the bedrock river valley walls support little vegetation.

Overall, a variety of age classes for all observed species was present in the riparian corridor. Vegetation was healthy and appeared hydrologically connected within the floodplain. The dominant substrate included boulders, cobbles, and gravel, and woody species were present and supported in the area. Areas with bedrock substrate supported little to no vegetation.

The Middle Yuba near Yellowjacket Creek exhibited the greatest amount of LWM in surveyed areas, with 45 pieces counted, while the Middle Yuba River upstream of Oregon Creek (~2 mi) had the fewest with one piece of LWM.

Thermal Refugia (Water Temperatures)

Monitoring results during the months of December through June indicate that maximum daily average water temperatures in the Middle Yuba River upstream of the confluence with the North Yuba River exceeded the upper tolerance WTI of 65°F for juvenile rearing and downstream movement during May 2009 and 2012, and during June 2009, 2010 and 2012.

Similarly, monitoring results during the year-round spring-run Chinook salmon juvenile rearing and downstream movement period suggest that maximum daily average water temperatures in the Middle Yuba River upstream of the confluence with the North Yuba River exceeded the upper tolerance WTI of 65°F (18.3°C) for juvenile rearing and downstream movement during June 2009, 2010 and 2012, during all sampled years in July, August and September, and during October 2011. Additionally, minimum daily average water temperatures in the Middle Yuba River upstream of the confluence with the North Yuba River frequently exceeded 65°F during July and August from 2009 through 2012.

Prey Availability (Macroinvertebrate Community Assemblages)

In the Middle Yuba River, three macroinvertebrate sampling locations were identified downstream of Our House Diversion Dam. Key survey findings are summarized below.

- Riparian vegetation was similar throughout the three sampling sites, as were basic water quality parameters and other site characteristics.
- There was no apparent trend in IBI or MMI scores as distance downstream of the diversion dam increased.
- The highest IBI and MMI scores were calculated for the site located below the Oregon Creek confluence (i.e., 69 and 64, respectively). This site had the greatest amount of riffle habitat with the least amount of pool habitat and a cobble dominated substrate. While the other two sites in the Middle Yuba River had IBI and MMI scores above 50, there was a substantial increase in pool habitat and boulder substrate. These riffle dominated habitats, which often include a large percentage of cobble, provide more surface area and interstitial space for BMI communities to be successful and may have contributed to higher metric scores. In addition, cobble dominated substrates provide more flow refugia for BMI, especially those with limited mobility.

6.4.4.3.5 Yuba River Upstream of Englebright Reservoir

The Yuba River downstream of New Colgate Powerhouse was dominated by gravel and boulders with some bedrock and sand, and channel habitats were predominantly pools and runs or step runs. There was no evidence of channel encroachment or bank instability. The average bankfull width in the site was 153 ft and the average flood prone width was 287 ft.

Overall, a variety of age classes for all observed species was present in the riparian corridor. Vegetation in the site was healthy and appeared hydrologically connected within the floodplain. Woody species were present in areas with substrate capable of supporting woody vegetation. The dominant substrate at transects included cobble gravel and sand with some bedrock and boulder. With the exception of the higher areas on cobble bars, woody species were present and supported to some degree on all substrates, with less cover in bedrock areas.

Thermal Refugia (Water Temperatures)

Monitoring results during the late December through June fall-run Chinook salmon juvenile rearing period and during the year-round spring-run Chinook salmon juvenile rearing and downstream movement period suggest that maximum daily average water temperatures in the Yuba River downstream of the New Colgate Powerhouse and downstream of Dobbins Creek did not exceed the upper tolerance WTI of 65°F (18.3°C) during 2009, 2010, 2011 and 2012.

Prey Availability (Macroinvertebrate Community Assemblages)

There were two macroinvertebrate sampling locations in the Yuba River, one upstream and one downstream of New Colgate Powerhouse. IBI and MMI scores were higher below New Colgate Powerhouse than those observed at the upstream location. An insufficient number of BMI were collected at the upstream site, making the calculated IBI and MMI scores less reliable. IBI and MMI scores appeared to be positively related to habitat type and substrate. The sampling location downstream of New Colgate Powerhouse was primarily composed of riffle (50%), with boulder (49%) and cobble (35%) as the most prominent substrates. Riparian vegetation was similar throughout the two sampling sites as were other general site characteristics. Water quality measurements varied due to the nature of water being released from the powerhouse. Significantly cooler water temperatures and increased dissolved oxygen were measured downstream of the powerhouse.

6.4.4.4 Downstream of Englebright Dam

6.4.4.4.1 Lower Yuba River

Historically, the Yuba River was connected to vast floodplains and included a complex network of channels, backwaters and woody material (NMFS 2009b). The legacy of hydraulic and dredger mining is still evident on the lower Yuba River where, for much of the river, dredger piles confine the river to an unnaturally narrow channel. The consequences of this unusual and artificial geomorphic condition include reduced floodplain and riparian habitat and resultant limitations in fish habitat, particularly for rearing juvenile salmonids (NMFS 2009b).

Juvenile Chinook salmon rearing habitat in the EFH Action Area includes the entire 24 miles of the lower Yuba River. In general, however, juvenile Chinook salmon have been observed throughout the lower Yuba River but with higher abundances above Daguerre Point Dam. The higher abundances above Daguerre Point Dam may be due to larger numbers of spawners, greater amounts of more-complex, high-quality cover, and lower densities of predators such as striped bass and American shad, which are restricted to areas below Daguerre Point Dam (SWRI et al. 2000).

Flow-Related Physical Instream Habitat

Habitat availability for Chinook salmon fry and juveniles are presented in Technical Memorandum 7-10. As presented in Technical Memorandum 7-10, habitat availability for Chinook salmon was calculated separately for both fry and juveniles, incorporating a “with cover” HSC, and a “without cover” HSC. The resultant habitat-discharge relationships were highly variable among simulated scenarios. For example, for Chinook salmon fry and juvenile with cover, the habitat-discharge relationship was unimodal in two of the modeled reaches, but bimodal in the other two modeled reaches. For fry and juvenile without cover, the habitat-discharge relationship was bimodal in three of the four modeled reaches. Also, for fry and juvenile with cover, habitat availability (WUA) peaked in the active channel between 300 and 700 cfs, whereas outside of the active channel fry and juvenile with cover WUA peaked at 5,000 cfs. For Chinook salmon fry and juvenile without cover, WUA peaked outside of the active channel between 15,000 and 21,100 cfs in three of the four modeled reaches.

Previous PHABSIM studies of large riverine systems in the Central Valley of California have not included fry or juvenile rearing lifestages due to the uncertainty and/or unreliability of habitat-discharge relationships. For example, in the FERC relicensing of the Oroville Facilities (FERC Project No. 2100), DWR (2005) reported that Chinook salmon (and steelhead) fry and juvenile rearing habitat-discharge relationships in the lower Feather River were ambiguous and difficult to interpret, and the results did not support a clear alternative or ideal discharge level.

Bioverification tests were conducted in Technical Memorandum 7-10 for candidate HSC datasets, including those for Chinook salmon (and steelhead) fry rearing. These tests yielded evidence that the transferability test results for Chinook salmon fry rearing were ambivalent. The Relicensing Participants chose to reassess all candidate HSC curves and, through a collaborative process of modifying specific curves, developed the final HSC datasets for use in Technical Memorandum 7-10. In most cases, a final HSC curve was derived by placing particular emphasis on a specific curve, then extending the tails of the curve into shallow/deeper or slower/faster water to encompass the full range of available site-specific data (i.e., to include all extreme observations). Bioverification tests were not even attempted on the resultant HSCs.

Due to the lack of unambiguous habitat-discharge relationships for fry and juvenile Chinook salmon rearing in the lower Yuba River, these lifestages are not evaluated using habitat-discharge relationships in this EFH assessment. Rather, the evaluation of juvenile Chinook salmon habitat suitabilities in the lower Yuba River in this Applicant-Prepared Draft EFH assessment focus on the primary stressor to these lifestages – water temperature.

Complex Channels and Floodplain Habitats

The following discussions related to existing physical habitat conditions pertaining to juvenile Chinook salmon in the lower Yuba River is summarized from Chapter 5 of the Applicant-Prepared Draft BA prepared for the Proposed Action.

The physical structure of rivers plays a significant role in determining the suitability of aquatic habitats for juvenile salmonids, as well as for other organisms upon which salmonids depend for food. These structural elements are created through complex interactions among natural geomorphic features, the power of flowing water, sediment delivery and movement, and riparian vegetation, which provides bank stability and inputs of large woody debris (Spence et al. 1996). The geomorphic conditions caused by hydraulic and dredge mining since the mid-1800s, and the construction of Englebright Dam, which affects the transport of nutrients, fine and coarse sediments and, to a lesser degree, woody material from upstream sources to the lower river, continue to limit habitat complexity and diversity in the lower Yuba River.

LWM creates both micro- and macro-habitat heterogeneity by forming pools, back eddies and side channels and by creating channel sinuosity and hydraulic complexity. This habitat complexity provides juvenile salmonids numerous refugia from predators and water velocity, and provides efficient locations from which to feed. LWM also functions to retain coarse sediments and organic matter in addition to providing substrate for numerous aquatic invertebrates (Spence et al. 1996).

In the lower Yuba River, mature riparian vegetation is scattered intermittently, leaving much of the banks devoid of LWM and unshaded – affecting components that are essential to the health and survival of the freshwater lifestages of salmonids (NMFS 2002). Although the ability of the lower Yuba River to support riparian vegetation has been substantially reduced by the historic impacts from mining activities, the dynamic nature of the river channel results in periodic creation of high-value shaded riverine aquatic (SRA) cover for fish and wildlife (Beak 1989).

Other important components of habitat structure at the micro-scale include large boulders, coarse substrate, undercut banks and overhanging vegetation. These habitat elements offer juvenile salmonids concealment from predators, shelter from fast current, feeding stations and nutrient inputs. At the macro-scale, streams and rivers with high channel sinuosity, multiple channels and sloughs, beaver impoundments or backwaters typically provide high-quality rearing and refugia habitats (Spence et al. 1996). The lower Yuba River can be generally characterized as lacking an abundance of such features.

Riparian Habitat and Instream Cover

Riparian Vegetation

SRA cover generally occurs in the lower Yuba River as scattered, short strips of low-growing woody species (e.g., Salix sp.) adjacent to the shoreline. Beak (1989) reported that the most extensive and continuous segments of SRA cover occur along bars where [then] recent channel migrations or avulsions had cut new channels through relatively large, dense stands of riparian vegetation. SRA cover consists of instream object cover and overhanging cover. Instream object cover provides structure, which promotes hydraulic complexity, diversity and microhabitats for juvenile salmonids, as well as escape cover from predators. The extent and quality of suitable rearing habitat and cover, including SRA, generally has a strong effect on juvenile salmonid production in rivers (Healey 1991 as cited in CALFED and YCWA 2005).

Since completion of New Bullards Bar Reservoir, the riparian community (in the lower Yuba River) has expanded under summer and fall streamflow conditions that have generally been higher than those that previously occurred (SWRCB 2003). However, the riparian habitat is not pristine. NMFS (2005a) reports …"*The deposition of hydraulic mining debris, subsequent dredge mining, and loss/confinement of the active river corridor and floodplain of the lower Yuba River which started in the mid-1800's and continues to a lesser extent today, has eliminated much of the riparian vegetation along the lower Yuba River. In addition, the large quantities of cobble and gravel that remained generally provided poor conditions for re-establishment and growth of riparian vegetation. Construction of Englebright Dam also inhibited regeneration of riparian vegetation by preventing the transport of any new fine sediment, woody debris, and nutrients from upstream sources to the lower river. Subsequently, mature riparian vegetation is sparse and intermittent along the lower Yuba River, leaving much of the bank areas unshaded and lacking in large woody debris. This loss of riparian cover has greatly diminished the value of the habitat in this area*."

Where hydrologic conditions are supportive, riparian and wetland vegetative communities are found adjacent to the lower Yuba River and on the river sides of retaining levees. These communities are dynamic and have changed over the years as the river meanders. The plant communities along the river are a combination of remnant Central Valley riparian forests, foothill oak/pine woodlands, agricultural grasslands, and orchards (Beak 1989).

According to CALFED and YCWA (2005), the lower Yuba River, especially in the vicinity of Daguerre Point Dam and the Yuba Goldfields, is largely devoid of sufficient riparian vegetation to derive the benefits (to anadromous salmonids) discussed above (Figure 6.4.4-2).

In 2012, YCWA conducted a riparian habitat study in the Yuba River from Englebright Dam to the confluence with the Feather River (see Technical Memorandum 6-2). Field efforts included descriptive observations of woody and riparian vegetation, cottonwood inventory and coring, and a large woody material (LWM) survey. The study was performed by establishing eight LWM study sites and seven riparian habitat study sites. One LWM study site was established within each of eight distinct reaches (i.e., Marysville, Hallwood, Daguerre Point Dam, Dry Creek, Parks Bar, Timbuctoo Bend, Narrows, and Englebright Dam). Riparian habitat sites were established in the same locations as the LWM study sites, with the exception of the Marysville study site. Riparian information regarding the Marysville Reach was developed, but no analysis was performed because of backwater effects of the Feather River.

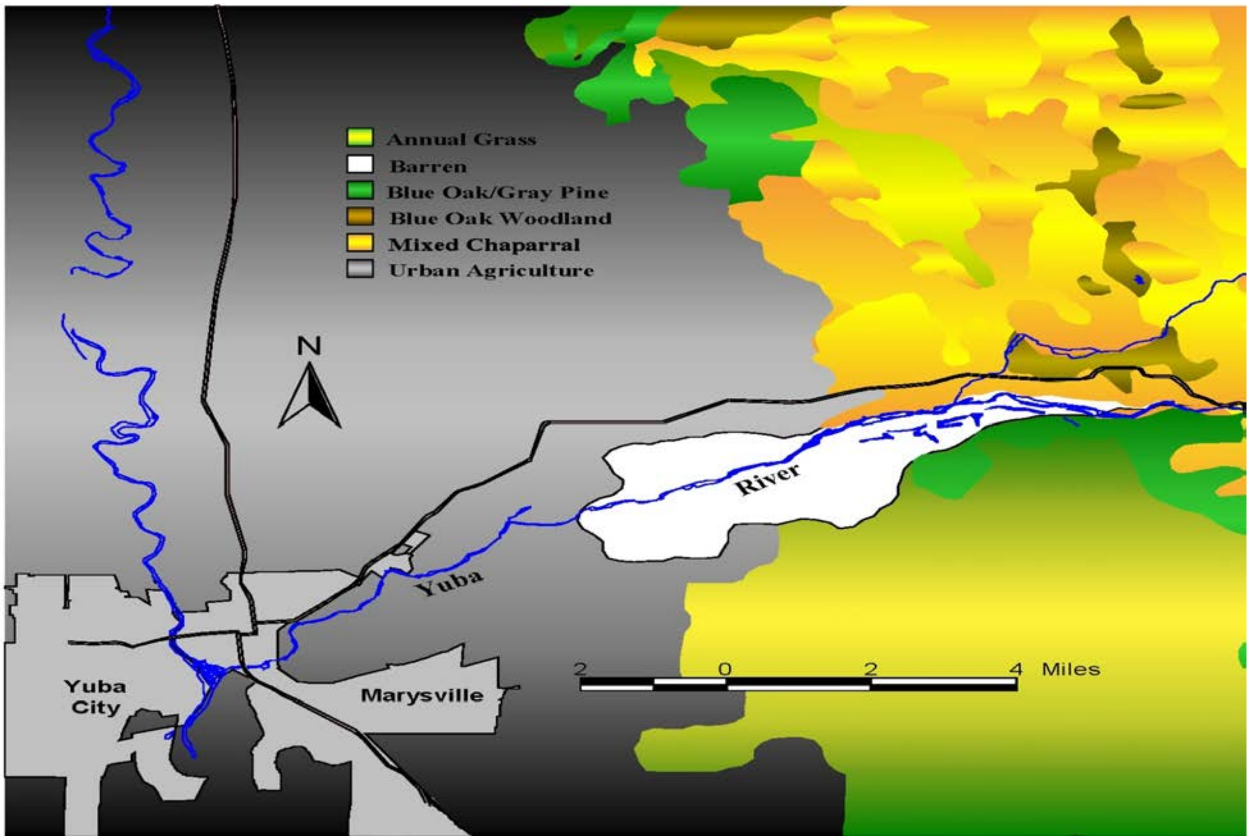

Figure 6.4.4-2. Vegetation communities in the lower Yuba River vicinity.
(Source: CALFED and YCWA 2005)

YCWA found that cottonwoods are one of the most abundant woody species in the lower Yuba River, and the most likely source of locally-derived large instream woody material due to rapid growth rates and size of individual stems commonly exceeding 2 ft in diameter and 50 ft in length. Cottonwoods exist in all lifestages including as mature trees, recruits, or saplings, and as seedlings. Cottonwoods are more abundant in downstream areas of the study area relative to upstream. Cottonwoods are distributed laterally across the valley floor. Of the estimated 18,540 cottonwood individuals/stands, 12 percent are within the bankfull channel (flows of 5,000 cfs or less), and 39 percent are within the floodway inundation zone (flows between 5,000 and 21,100 cfs). However, recruitment patterns of cottonwood have not been analyzed with respect to time or with any more detail regarding channel location (see Technical Memorandum 6-2).

A total of 97 cottonwood trees were cored to estimate age. Age estimates ranged from 11 to 87 years. The cottonwood tree age analysis resulted in age estimates that place the year of establishment for trees in a range of years from ±7 to 16 years, which is too wide to allow for linking the establishment of trees to any year's specific hydrologic conditions (YCWA 2013).

Instream Woody Material

Instream woody material provides escape cover and relief from high current velocities for juvenile salmonids and other fishes. LWM also contributes to the contribution of invertebrate food sources, and micro-habitat complexity for juvenile salmonids (NMFS 2007). Snorkeling observations in the lower Yuba River have indicated that juvenile Chinook salmon had a strong preference for near-shore habitats with instream woody material (Jones & Stokes 1992).

There is currently a lack of consensus regarding the amount of instream woody material occurring in the lower Yuba River (Corps 2012a). It has been suggested (CALFED and YCWA 2005) that the presence of Englebright Dam has resulted in decreased recruitment of LWM to the lower Yuba River, although no surveys or studies were cited to support these statements. Some woody material may not reach the lower Yuba River due to collecting on the shoreline and sinking in Englebright Reservoir (Corps 2012a). However, Englebright Dam does not functionally block woody material from reaching the lower Yuba River because there is no woody material removal program implemented for Englebright Reservoir, and accumulated woody material therefore spills over the dam during uncontrolled flood events (R. Olsen, Corps, pers. comm. 2011, as cited in Corps 2012a).

About 8.7 miles of the lower Yuba River downstream of Englebright Dam, distributed among study sites per reach, were surveyed and evaluated for pieces of wood (YCWA 2013). The number of pieces of wood was relatively similar above and below Daguerre Point Dam (i.e., about 5,100 and 5,750 pieces, respectively). Woody material was generally found in bands of willow (*Salix* sp.) shrubs near the wetted edge, dispersed across open cobble bars, and stranded above normal high-flow indicators. Most of the woody material was diffuse and located on floodplains and high floodplains, with only about a quarter of the material in heavy concentrations (YCWA 2013).

Most (77-96%) pieces of wood found in each reach were smaller than 25 ft in length and smaller than 24 inches in diameter, which is the definition of LWM used in Technical Memorandum 6-2. These pieces would be typically floated by flood flows and trapped within willows and alders above the 21,100 cfs line, which is defined as the flow delineating the floodway boundary (YCWA 2013).

Instream woody material was not evenly distributed throughout the reaches. For the smaller size classes (i.e., shorter than 50 ft, less than 24 inches in diameter), the greatest abundance of pieces was found in the Hallwood or Daguerre Point Dam reaches, with lower abundances above and below these reaches (YCWA 2013).

The largest size classes of LWM (i.e., longer than 50 ft and greater than 24 inches in diameter) were rare or uncommon (i.e., fewer than 20 pieces total) with no discernible distribution. Pieces of this larger size class were counted as “key pieces”, as were any pieces exceeding 25 inches in diameter and 25 ft in length and showing any morphological influence (e.g., trapping sediment or altering flow patterns). A total of 15 key pieces of LWM were found in all study sites, including six in the Marysville study site. Few of the key pieces were found in the active channel or exhibiting channel forming processes (YCWA 2013).

Natural River Morphology and Function

According to NMFS (2009), attenuated peak flows and controlled flow regimes have altered the lower Yuba River’s geomorphology and have affected the natural meandering of the river downstream of Englebright Dam.

As reported by RMT (2013), preliminary evaluation of available data collected to date related to Yuba River fluvial geomorphology indicates that the Yuba River downstream of Englebright Dam has complex river morphological characteristics. Evaluation of the morphological units in the Yuba River as part of the spatial structure analyses indicates that, in general, the sequence and organization of morphological units is non-random, indicating that the channel has been self-sustaining of sufficient duration to establish an ordered spatial structure (RMT 2013).

The Yuba River downstream of Englebright Dam exhibits lateral variability in its form-process associations (RMT 2013). In the Yuba River, morphological unit organization highlights the complexity of the channel geomorphology, as well as the complex and diverse suite of morphological units. The complexity in the landforms creates diversity in the flow hydraulics which, in turn, contributes to a diversity of habitat types available for all riverine lifestages of anadromous salmonids, including juvenile rearing and downstream movement, in the Yuba River downstream of Englebright Dam (RMT 2013).

Floodplain Habitat

NMFS (2009) listed the loss of floodplain habitat in the lower Yuba River as one of the key stressors affecting anadromous salmonids (including spring-run Chinook salmon). NMFS (2009) stated …“*Historically, the Yuba River was connected to vast floodplains and included a complex network of channels, backwaters and woody material. The legacy of hydraulic and dredger mining is still evident on the lower Yuba River where, for much of the river, dredger piles confine the river to an unnaturally narrow channel. The consequences of this unusual and artificial geomorphic condition include reduced floodplain and riparian habitat and resultant limitations in fish habitat, particularly for rearing juvenile salmonids.*”

NMFS (2009) further stated that in the lower Yuba River, controlled flows and decreases in peak flows has reduced the frequency of floodplain inundation resulting in a separation of the river channel from its natural floodplain. Within the Yuba Goldfields area (RM 8–14), confinement of the river by massive deposits of cobble and gravel derived from hydraulic and dredge mining activities resulted in a relatively simple river corridor dominated by a single main channel and large cobble-dominated bars, with little riparian and floodplain habitat (DWR and PG&E 2010).

Loss of off-channel habitats such as floodplains, riparian, and wetland habitats has substantially reduced the productive capacity of the Central Valley for many native fish and wildlife species, and evidence is growing that such habitats were once of major importance for the growth and survival of juvenile salmon (Moyle 2002). Recent observations on the lower Yuba River indicate that remnant side channels and associated riparian vegetation play a similar role by providing flood refugia, protection from predators, and abundant food for young salmonids and other native fishes. These habitats also promote extended rearing and expression of the stream-type rearing characteristic of spring-run Chinook salmon (DWR and PG&E 2010).

As reported by RMT (2013), despite some flow regulation, the channel and floodplain in the lower Yuba River are highly connected, with floods spilling out onto the floodplain more frequently than commonly occurs for unregulated semiarid rivers. Some locations exhibit overbank flow well below 5,000 cfs, while others require somewhat more than that. In any given year, there is an 82 percent chance the river will spill out of its bankfull channel and a 40 percent chance that the floodway will be fully inundated. These results demonstrate that floodplain inundation occurs with a relatively high frequency in the lower Yuba River compared to other Central Valley streams which, in turn, contributes to a diversity in habitats available for anadromous salmonids (RMT 2013).

RMT (2013) conducted a flood-frequency analysis of the annual peak discharges recorded at the USGS stream gage near Marysville (#11421000) that showed average annual return periods of 1.25 years and 2.5 years for the bankfull and flood discharges, respectively. Bankfull flows for similar rivers are generally assumed to occur with return periods of 1.5-2 years. The fact that the lower Yuba River is less than this implies that the channel is naturally undersized relative to generalized expectations and flows spill into the floodplain at a more frequent rate (RMT 2013).

Fry and Juvenile Salmonid Stranding

Juvenile salmonids and other aquatic organisms can become stranded on gravel bars or isolated in off-channel habitats (e.g., side channels, backwaters) as a result of flow fluctuations in rivers. Bar stranding or ‘beaching’ is the type of stranding that occurs on low-gradient bars in which fish are exposed to the air or isolated in tiny pockets of standing water that may be present between larger particles or below the substrate on the bar surface. Off-channel stranding or ‘isolation’ is the type of stranding that occurs in backwaters, secondary channels, and other floodplain habitats that become disconnected from the main river by receding flows.

Field observations in the lower Yuba River indicate that Chinook salmon are most susceptible to bar stranding during the post-emergent fry stage (30-40 mm in length). Newly emerged fry appear to be particularly vulnerable to bar stranding because of their preference for shallow, low-velocity stream margins and use of cobble substrate as cover. Based on the densities and sizes of juvenile salmon observed in the study sites, most if not all of the fish visible to divers in shallow, nearshore areas were able to avoid stranding during day and nighttime flow reductions. These fish were generally greater than 40 mm in length and were observed maintaining position and actively feeding above the substrate. Field observations indicate that the potential for bar stranding of juvenile salmon decreases through the spring as the salmon’s body sizes increase.

Controlled flow reductions due to Project operations in the fall are completed by early September, and flows then are maintained at relatively stable levels through the fall to provide stable spawning flows for spring-run and fall-run Chinook salmon and to protect redds from dewatering. These Project operations also act to minimize stranding of Chinook salmon fry, which begin to emerge from their redds in November. Thereafter, lower Yuba River flows during the winter and spring often are uncontrolled, and stranding of Chinook salmon fry can occur naturally during periods of uncontrolled runoff and spills, either through uncontrolled flow fluctuations or as runoff subsides and flows drop to controllable levels.

No relationship was observed between ramping rates and the incidence of fry stranding on low gradient bars within the observed range of ramping rates (flow reductions of 100 to 200 cfs per hour at Narrows 2 Powerhouse) (B. Mitchell, ICF/JSA, pers. comm. 2012). These ramping rates corresponded to changes in stage of 0.4 to 1 inch per hour at the study sites. A rate of 1 inch per hour is generally considered protective of juvenile salmonids, and is generally within the range of natural rates of stage reductions in unregulated rivers (Olson and Metzgar 1987). Nevertheless, some stranding of post-emergent Chinook salmon fry has been observed even at half this rate, suggesting that young fry have limited ability to detect or respond to receding water levels, regardless of the ramping rate. Similarly, surveys conducted by YCWA indicate that the small size and strong association of young fry with substrates limit their ability to detect or respond to receding water levels, regardless of ramping rate.

RD-1644 specifies a maximum rate of change or ramping rate of 500 cfs/hr. (RD-1644, p. 178, term 3.a.) YCWA's standard operations objective at Narrows 2 has been to reduce flows at a target ramping rate of 100 cfs per hour during normal operations, and at a target ramping rate of 200 cfs per hour when passing storm flows, whenever feasible. The results of surveys show that these ramping rates are protective of juvenile salmonids once they grow beyond the sensitive early fry stage.

Field observations made by YCWA indicate that off-channel stranding of juvenile Chinook salmon can occur in the winter and spring following uncontrolled peak runoff or spill events. Lower Yuba River flows during the winter and early spring often are uncontrolled, and strandings of juvenile Chinook salmon (presumably including spring-run Chinook salmon) can occur naturally during uncontrolled peak runoff (spill) events (through uncontrolled flow fluctuations) or after these events, as flows return to controllable levels. Following the winter period of uncontrolled flows, river flows typically decline to levels that are considered controlled and subject to the RD-1644 criteria as early as March, but in the wetter years controlled flow reductions typically do not begin to occur until later in the spring or summer.

The potential for off-channel stranding is highest for Chinook salmon fry following uncontrolled peak runoff or spills in winter and early spring (December-March). Field surveys conducted by YCWA of potential off-channel stranding sites in the lower Yuba River before and after lower Yuba River flow reductions in early April 2007, early June 2008, and late June 2010 indicate that off-channel stranding is a site-specific phenomenon that depends on the complex interaction of hydrology, site conditions (stage-discharge relationships and channel and bar morphology), and species life history, habitat use, and behavior. Consequently, the potential for off-channel stranding for a given flow reduction varies by site, reach, and season.

While floodplain and off-channel habitats are sources of stranding mortality, studies have documented that there also are significant growth and potential survival benefits associated with floodplain and off-channel habitats that are used by Chinook salmon in the Central Valley (Limm and Marchetti 2009; Jeffres et al. 2008; Sommer et al. 2001). Consequently, floodplain and other off-channel habitats serve important refuge and rearing functions for native fishes, and likely contributed substantially to the productive capacity and life history diversity of Chinook salmon and other fish species in the Sacramento River system before large-scale channel modifications, levee construction, and agricultural conversion of floodplains (Lindley et al. 2009; Yoshiyama et al. 1998).

Field observations indicate that the occurrence of off-channel stranding is relatively insensitive to flow ramping rates and is largely a function of the magnitudes of winter and spring flows (which determine the accessibility of fry to off-channel areas), site conditions (particularly channel and floodplain morphology), and seasonal abundance, habitat use, and emigration timing of juvenile salmon and steelhead. The fate of juvenile salmonids in isolated off-channel sites can also vary depending on the suitability of habitat conditions in these sites through the summer and fall. Long-term monitoring of off-channel sites in the lower Yuba River during summer and fall 2008 confirmed that some of these sites can support juvenile salmonids for long periods of time and provide favorable rearing conditions based on observed growth and survival (B. Mitchell, ICF/JSA, pers. comm. 2012). Following high winter flows, fish stranding surveys indicate that the quality of off-channel habitat varies as a function of water depth, cover availability, water quality, and the presence or absence of predators. Long-term monitoring of several disconnected groundwater-fed channels in 2008 confirmed that some sites can support high densities and growth of juvenile salmon and other native fish species through the spring and summer. Habitat conditions that appear to be important for extended off-channel rearing are the presence of groundwater flow, sufficient water depths, riparian and aquatic vegetation, and the absence of large predatory fish (e.g., pikeminnow).

Thermal Refugia

The upper tolerance WTI value of 65°F was developed by RMT (2013) to apply to both the spring-run and fall-run Chinook salmon juvenile rearing and downstream movement lifestages. The value of 65°F was selected by the RMT because, in addition to being specifically referenced in the literature, it represented an intermediate value between 64°F and 66.2°F, values which also are often referenced in the literature. Justification for the 65°F water temperature index value includes: (1) preferred for growth and development of fry and juvenile Chinook salmon in the Feather River; (2) disease outbreaks and mortalities increase at water temperatures above 65°F; (3) optimum temperature for growth appears to occur at about 66.2°F; (4) optimal range for Chinook salmon survival and growth from 53°F to 64°F; and (5) survival of Central Valley juvenile Chinook salmon declines at temperatures greater than 64.4°F.

Evaluation of the spring-run Chinook salmon and fall-run Chinook salmon juvenile rearing and downstream movement upper tolerance WTI value in the lower Yuba River was conducted using simulated water temperatures under existing conditions (i.e., the Environmental Baseline) and the Without-Project scenario. In summary, modeled water temperatures are generally suitable during the spring-run and fall-run Chinook salmon juvenile rearing and downstream movement periods, with the exception of July and August of the spring-run Chinook salmon juvenile rearing and downstream movement lifestage at the Marysville location under existing conditions. However, as previously mentioned, over the 2007-2013 monitoring period, water temperatures at Marysville never exceeded or even reached 65°F during any time of the year. Simulated water temperatures under the existing condition are substantially more suitable than those under the Without-Project scenario for the spring-run and fall-run Chinook salmon juvenile rearing and downstream movement lifestages.

Prey Availability (Macroinvertebrate Community Assemblages)

YCWA (2013) conducted BMI surveys in the lower Yuba River downstream of Englebright Dam. The surveys were completed in late July of 2012. The study took place at six sites in representative locations between Englebright Dam and the Feather River Confluence. Due to the unwadeable conditions present in the study area, methods utilized in the collection of BMI and sampling of habitat parameters in this study were derived from two protocols suitable for large unwadeable rivers - the United States Environmental Projection Agency's Environmental Monitoring and Assessment Program, and the Large River Bioassessment Protocol.

Physical habitat varied among the sites, with substrate size decreasing and the amount of riffle habitat increasing from upstream to downstream. An estimated 183,682 invertebrates were collected from the six sample sites. A subset of 3,665 invertebrates was randomly sorted from the whole samples representing six aquatic insect orders. BMIs from the families Chironomidae and Baetidae were among the most commonly observed. In addition, aquatic crustaceans, arachnids, annelids, gastropods, mollusks, nemerteans, and turbellarians also were identified. Eighteen common BMI metrics were calculated for each site. Although metric values were not consistently related to distance downstream of a dam or reservoir, some BMI metrics were correlated with physical habitat characteristics, such as streambed substrate and habitat composition.

The quality of each site was generally a factor of substrate, channel size and morphology. Overall, the sampling site located in the Englebright Dam Reach below the Narrows 2 powerhouse (RM 23) showed the greatest degree of impairment relative to the other sites, possibly due to very little gravel and stagnant water on the margins of the river, as boulders are a less productive substrate type relative to cobble and gravel. The sampling site located in the Hallwood Reach below Daguerre Point Dam showed the best overall reported BMI metric scores. The relatively high abundance at this site was likely due to the sample plots being dominated by gravel and cobble, which have a large amount of surface area and interstitial spaces available to support higher densities of BMIs.

Predation

Predation can occur in three forms: (1) natural; (2) predation resulting from a relative increase in predator habitat and opportunity near major structures and diversions; and (3) predation resulting from minimal escape cover and habitat complexity for prey species (CALFED and YCWA 2005). For the purpose of stressor identification in this EFH assessment, predation includes the predation associated with increases in predator habitat and predation opportunities for piscivorous species created by major structures and diversions, and predation resulting from limited amounts of prey escape cover in the lower Yuba River.

The extent of predation on juvenile Chinook salmon in the lower Yuba River is not well documented (NMFS 2009). Although predation is a natural component of salmonid ecology, the rate of predation of salmonids in the lower Yuba River has potentially increased through the introduction of non-native predatory species such as striped bass *(Morone saxatilis)*, largemouth bass *(Micropterus salmoides)* and American shad *(Alosa sapidissima)* and through the alteration of natural flow regimes and the development of structures that attract predators (NMFS 2009).

Predatory fish are known to congregate around structures in the water including dams, diversions and bridges, where their foraging efficiency is improved by shadows, turbulence and boundary edges (CDFG 1998). Thus, juvenile salmonids can also be adversely affected by Daguerre Point Dam on their downstream migration. Daguerre Point Dam creates a large plunge pool at its base, which provides ambush habitat for predatory fish in an area where emigrating juvenile salmonids may be disoriented after plunging over the face of the dam into the deep pool below (NMFS 2002). The introduced predatory striped bass and American shad have been observed in this pool (CALFED and YCWA 2005). In addition to introduced predatory species, several native fish species also prey on juvenile salmonids in the lower Yuba River, including Sacramento pikeminnow, hardhead and large juvenile and adult rainbow trout/steelhead (CALFED and YCWA 2005). It has been suggested that the rate of predation of juvenile salmonids passing over dams in general, and Daguerre Point Dam in particular, may be unnaturally high (NMFS 2007), although specific studies addressing this suggestion have not been conducted.

In addition to the suggestion of increased rates of predation resulting from disorientation of juveniles passing over Daguerre Point Dam into the downstream plunge pool, it also has been suggested that unnaturally high predation rates may also occur in the diversion channel associated with the South Yuba/Brophy diversion (NMFS 2007). Other structure-related predation issues include the potential for increased rates of predation of juvenile salmonids: 1) in the entryway of the Hallwood-Cordua diversion canal upstream of the fish screen; and 2) at the point of return of fish from the bypass pipe of the Hallwood-Cordua diversion canal into the lower Yuba River. These structures are not part of the Project, and the Technical Memorandum for study 7-13 *Effects on Fish Facilities* documented that existing project flows do not affect the operation of these structures.

Although areas of EFH downstream of the lower Yuba River are not anticipated to be affected by the Proposed Action, the waterways (i.e., Feather and Sacramento rivers, Delta) discussed below are included for completeness in characterizing Pacific Coast salmon EFH.

6.4.4.4.2 Feather River

The Yuba River flows into the Feather River near the City of Marysville, 39 river miles (RM) downstream of the City of Oroville (NMFS 2009). Most juvenile Chinook salmon emigrate from the lower Feather River within a few days of emergence, and 95 percent of the juvenile Chinook have typically emigrated from the Oroville Facilities project area by the end of May (DWR 2007). EFH in the reach of the Feather River extending from the confluence of the Yuba River downstream to the confluence of the Sacramento River is primarily used as a migration corridor by juvenile Chinook salmon. Although lower Yuba River juvenile Chinook salmon may utilize EFH in the Feather River during rearing and downstream movement, the Proposed Action does not have the potential to affect EFH in the lower Feather River.

6.4.4.4.3 Sacramento River

Approximately 67 miles downstream of the City of Oroville, the Feather River flows into the Sacramento River near the town of Verona (DWR 2007, as cited in NMFS 2009). The Feather River is considered to be a major tributary to the Sacramento River and provides about 25 percent of the flow[27] in the Sacramento River (DWR 2007, as cited in NMFS 2009). EFH in the reach of the lower Sacramento River extending from the confluence of the lower Feather River downstream to the Delta is primarily used as a migration corridor by juvenile Chinook salmon. Although lower Yuba River juvenile Chinook salmon may utilize EFH in the lower Sacramento River during rearing and downstream movement, the Proposed Action will not affect EFH in the lower Sacramento River.

6.4.4.4.4 Sacramento-San Joaquin Delta

Estuaries are important rearing and foraging habitat for juvenile Chinook salmon (PFMC 2011). Ehinger et al. (2007) found that certain types of Delta habitat, distributary channels and wetlands in particular, may have a major role in juvenile Chinook salmon productivity. Although lower Yuba River juvenile Chinook salmon would utilize EFH in the Delta during rearing and downstream movement, the Proposed Action will not affect EFH (e.g., sensitive habitats such as salt marsh and tidal wetlands, primary productivity) in the Delta.

[27] As measured at Oroville Dam.

SECTION 7.0

ANALYSES OF POTENTIAL EFFECTS OF THE PROPOSED ACTION ON ESSENTIAL FISH HABITAT FOR MANAGED SPECIES

The purpose of this EFH assessment is to assist NMFS in determining whether the Proposed Action "may adversely affect" Pacific Coast salmon EFH for Federally managed commercial fishery species (i.e., Chinook salmon) within the Action Area. An "adverse affect" is defined as any impact which reduces the quality and/or quantity of EFH (50 C.F.R. § 600.810(a)).

Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 C.F.R. § 600.810).

7.1 EFH Assessment Approach

According to NMFS (2004a), an EFH Assessment is required to include the following information: 1) a description of the Proposed Action; 2) an analysis of the effects, including cumulative effects, of the Proposed Action on EFH, the managed species, and associated species (e.g., major prey species), including affected lifestages; 3) the Federal agency's views regarding the effects of the Proposed Action on EFH; and 4) proposed mitigation, if applicable (see 50 C.F.R. § 600.920(e)(3)&4)). Rather than repeating information provided in the BA, the EFH assessment may cross-reference relevant sections in the BA that analyze potential project impacts on species or critical habitat (50 C.F.R. § 600.920(f)).

In assessing the potential impacts of a proposed action, PFMC and NMFS also are guided by several general considerations, including the extent to which: 1) the activity would directly and indirectly affect the distribution, abundance, health, and continued existence of salmon and their EFH; 2) the potential for cumulative impacts to occur; 3) adverse impacts can be avoided through project modification or alternative site selection; and 4) minimization or mitigation that may be used to reduce unavoidable loss of habitat functions and values (PFMC 1999).

As previously discussed, the Proposed Action does not have the potential to influence or alter many of the habitat components that are typically used to evaluate "properly functioning condition" of freshwater EFH for Chinook salmon. Nevertheless, the manner in which the principles of a "properly functioning condition" assessment described in NMFS (1996), NMFS (2009a) and PFMC (2009) are applied to assessment of the Proposed Action in this EFH assessment are described below.

7.2 Habitat Descriptors

The various elements that comprise EFH and determine its utility and function can be assessed to define and evaluate current EFH conditions and potential conditions as a result of the Proposed Action. The concept of properly functioning habitat links various habitat elements with habitat function and is used in this assessment as a basis for describing current Chinook salmon EFH and identifying potential Project-related changes in these elements that could affect EFH in the Action Area.

Previously, NMFS (1996) developed an analytical methodology utilizing a *Matrix of Pathways and Indicators* (MPI; often called "The Matrix") for making effects determinations based on the condition of the environmental baseline (e.g., existing aquatic habitat conditions) and the likely effects of a given project. The pathways for determining the effects of an action are represented as conceptual groupings (e.g., water quality) of habitat condition indicators (e.g., temperature). The effects of the action upon each indicator are classified by whether it will degrade, maintain or restore[28] the indicator. The MPI provides a consistent, but geographically adaptable, framework for effects determinations. The pathways and indicators, as well as the ranges of their associated criteria, are amenable to alteration through the process of watershed analysis, and were designed to be applied to a wide range of environmental conditions (NMFS 1996; 1999). As stated by NMFS (1996), "*There will be circumstances where the ranges of numerics or descriptions in the matrix simply do not apply to a specific watershed or basin. In such a case, the evaluator will need to provide more biologically appropriate values. When this occurs, documentation justifying these changes should be presented in the biological assessment, habitat conservation plan, or other appropriate document*…"

For purposes of assessing EFH in the Action Area, different indicators and stressors were evaluated for areas designated as Chinook salmon EFH upstream of Englebright Dam, and for areas of EFH downstream of Englebright Dam, as further described below.

Currently, Chinook salmon may not access EFH located in the upper Yuba River Watershed because of the presence of the Corps' Englebright Dam. Thus, the assessment of EFH upstream of Englebright Dam is restricted to specific habitat considerations. To evaluate potential effects of the Proposed Action on EFH upstream of Englebright Dam, analyses generally followed the habitat-based "properly functioning condition" framework provided in NMFS (1996) using information from several recently conducted FERC studies in the upper Yuba River Watershed.

NMFS (1996) identifies ranges of criteria to facilitate and standardize determinations of effects on anadromous salmonids associated with proposed actions. The ranges of criteria are designed to assist in determining whether specific habitat attributes are "properly functioning," "at risk," or "not functioning properly" (NMFS 1996). A properly functioning condition is defined as "*the sustained presence of natural habitat-forming processes in a watershed (e.g., riparian*

[28] Although the term "restore" is used to be consistent with NMFS (1996), the effects of some Proposed Action activities (including conservation measures) actually represent enhancement rather than "restoration" relative to existing aquatic habitat conditions.

community succession, bedload transport, precipitation runoff pattern, channel migration) that are necessary for the long-term survival of the species through the full range of environmental variation" (NMFS 1999).

For this assessment, several indicators were modified or eliminated so that the assessment focuses on conditions that are more likely to relate the Proposed Action with EFH in the Yuba River Watershed. Additionally, pathways and indicators that are large scale, such as watershed conditions and changes in drainage network, and that are not clearly related to Project effects on EFH, are not addressed in this assessment. Indicators evaluated for the Yuba River watershed upstream of Englebright Dam include: (1) habitat access (physical barriers); (2) flow/hydrology; (3) water temperature; (4) sediment/turbidity; (5) chemical contamination/nutrients; (6) width/depth ratio; (7) streambank conditions; (8) substrate; (9) LWM; (10) watershed conditions (riparian reserves); and (11) prey availability.

Because Chinook salmon occupy the lower Yuba River downstream of Englebright Dam, a large amount of information has been developed regarding the manner in which numerous stressors affect habitat, including EFH, and the manner in which these stressors affect the species' ability to utilize the habitat in the lower Yuba River. Characterization of the existing condition of EFH in the lower Yuba River takes advantage of the information developed for habitat-related stressors for Chinook salmon in the lower Yuba River.

7.3 Summary of Existing EFH Conditions

7.3.1 Yuba River Watershed Upstream of Englebright Dam

7.3.1.1 North Yuba River (New Bullards Bar Dam Reach)

7.3.1.1.1 Habitat Access (Physical Barriers)

Under existing habitat conditions, the EFH in the North Yuba River is considered to be "not properly functioning" due to the presence of the Corps' 260-foot-high Englebright Dam, which currently blocks access by managed species (i.e., Chinook salmon) to available EFH in the Yuba River watershed upstream of Englebright Dam.

7.3.1.1.2 Flow/Hydrology

Typical of the semiarid climate of the Central Valley, the natural or "*unimpaired*" flow regime of the North Yuba River historically varied greatly in the magnitude, timing, duration, and frequency of flows, both inter-annually and seasonally. The frequency and distribution of habitat types and microhabitat features present in the North Yuba River before construction of New Bullards Bar Dam, mining and other past activities were most likely substantially different from those currently found in the river. Presently, New Bullards Bar Dam and Reservoir are used to control about one half of the flood flows of the Yuba River watershed, with the remainder of the runoff being largely uncontrolled. The Project provides essential flood management by reducing the peak flood flow in the North Yuba River and thereby reduces peak water levels on levees on the Yuba River and the Feather River in the Yuba City/Marysville area downstream to the

Sacramento River. Under existing habitat conditions, flood control operations have the potential to affect seasonal peak flows, channel morphology, sediment transport and EFH in the North Yuba River.

Under existing habitat conditions, EFH in the North Yuba River is currently not accessible and not occupied by managed species (i.e., Chinook salmon) due to the presence of the Corps' Englebright Dam. Therefore, it is not appropriate to analyze whether flow regimes in the North Yuba River are properly functioning for Chinook salmon EFH. Instead, the analysis addresses the seasonality of flows and directional changes (increased vs. decreased) in flow that would result from implementation of the Proposed Action.

7.3.1.1.3 Water Quality

Thermal Refugia (Water Temperature)

Available monitoring data suggest that for this EFH indicator (i.e., thermal refugia), the North Yuba River could be considered "at risk" or "not properly functioning" under the baseline (i.e., existing habitat conditions).

Sediment/Turbidity

The North Yuba River is considered to be "properly functioning" under existing habitat conditions because sediment and turbidity are low.

Chemical Contamination/ Nutrients

Because the SWRCB has identified the North Yuba River from New Bullards Bar Dam to the confluence with the Middle Yuba River as Clean Water Act Section (§) 303(d) State Impaired for mercury, this EFH indicator (i.e., chemical contamination/nutrients) for the North Yuba River is considered to be "at risk" under existing habitat conditions.

7.3.1.1.4 Channel Condition and Dynamics

Width/Depth Ratio

Because ground-mapped reaches in the New Bullards Bar Reach of the North Yuba River identified a width/depth ratio of 20 for the reach, this EFH indicator is considered to be "not properly functioning" under existing habitat conditions.

Streambank Conditions

The channel in the North Yuba River is characterized by large substrate, steep gradients, vertical confinement, low bank erodibility, and low fine sediment accumulation. Ground-mapped data for the 2.3 miles of the North Yuba River did not identify any bank erosion as a percentage of the reach. Therefore, it is assumed that the banks in this reach are stable and it is considered to be properly functioning.

7.3.1.1.5 Habitat Elements

Substrate

In the North Yuba River above the Middle Yuba River, cobble and boulder are the dominant and sub-dominate substrates, respectively. The average percent cobble embeddedness was reported to be 21 percent. Therefore, this EFH indicator (i.e., substrate) is considered to be “at risk” under existing habitat conditions.

Large Woody Material

In consideration of the fact that unobstructed downstream movement of LWM is currently restricted the Middle Yuba River, this EFH indicator is considered to be “at risk” under existing habitat conditions.

7.3.1.1.6 Watershed Conditions (Riparian Reserves)

Although riparian vegetation is limited, YCWA determined that most stream reaches in the North Yuba River were healthy because there is no indication of a lack of riparian function in these areas. YCWA evaluated most stream reaches as healthy because recruits of woody vegetation and a variety of age classes were present in all stream reaches, indicating that germination is occurring under current Project operation and lateral distribution of woody species is within the expected range, with willows near the wetted edge and other hardwood species occurring farther upslope (Harris and McBride 2013).

7.3.1.1.7 Prey Availability

Habitat in some locations in the watershed is not conducive to high abundances of BMI, especially within the North Yuba River where large, granitic boulders dominate the stream, leaving less surface area for BMI. BMI samples were taken at a single site in the North Yuba River at a location approximately 2.0 RM downstream of New Bullards Bar Dam near the confluence with the Middle Yuba River. Sampling at the location provided 325 total organisms per grid, which is below the standard minimum of 500 organisms per grid used for IBI and MMI scoring. Therefore, the reliability of the calculated indices scores are low. Nonetheless, the IBI score was 21 and MMI was 16 and classified per MMI standards as in poor condition. Therefore, prey availability may be considered to be “not properly functioning” under existing conditions.

7.3.1.2 Middle Yuba River (with emphasis on the ~1.5 miles of EFH upstream from the confluence of the Middle Yuba River and the North Yuba River)

7.3.1.2.1 Habitat Access (Physical Barriers)

Under existing habitat conditions, the EFH in the Middle Yuba River is considered to be “not properly functioning” due to the presence of the Corps’ 260-foot-high Englebright Dam, which currently blocks Chinook salmon access to all available EFH in the Yuba River Watershed upstream of Englebright Dam.

7.3.1.2.2 Flow/Hydrology

Under existing habitat conditions, EFH in the Middle Yuba River is currently not accessible and not occupied by managed species (i.e., Chinook salmon) due to the presence of the Corps Englebright Dam. Therefore, it is not appropriate to analyze whether flow regimes in the Middle Yuba River are properly functioning for Chinook salmon EFH. Instead, the analysis addresses the seasonality of flows and directional changes (increased vs. decreased) in flow that would result from implementation of the Proposed Action.

7.3.1.2.3 Water Quality

Thermal Refugia (Water Temperature)

Available monitoring data suggest that, for this EFH indicator, the Middle Yuba River could be considered to be "at risk" or "not properly functioning" under existing habitat conditions.

Sediment/Turbidity

Under existing habitat conditions, the Middle Yuba River is considered to be "properly functioning" because water quality sampling results indicated that sediment and turbidity are low.

Chemical Contamination/ Nutrients

Because the SWRCB identified the Middle Yuba River from Bear Creek to the North Yuba River as CWA (§) 303(d) State Impaired for mercury, this EFH indicator is considered to be "at risk" for the Middle Yuba River under existing habitat conditions.

7.3.1.2.4 Channel Condition and Dynamics

Width/Depth Ratio

Because the average width/depth ratio for the ground-mapped reaches in the Middle Yuba River – Oregon Creek and Our House Diversion Dam Reaches was calculated to be 24, this EFH indicator would be considered to be "not properly functioning" under existing habitat conditions.

Streambank Conditions

Ground-mapped data for the 2.94 miles of the Middle Yuba River did not identify any bank erosion as a percentage of the reach. Because of the amount of bedrock and boulder control, channel stability is good and bank erosion hazard is low to very low. Therefore, it is assumed that the banks in this reach are stable, and they would be considered to be properly functioning.

7.3.1.2.5 Habitat Elements

Substrate

In the Middle Yuba River, cobble and gravel were found to be the dominant and sub-dominate substrates, respectively. The average percentage of cobble embeddedness below the Oregon Creek confluence was reported to be 35 percent, and 37 percent above the North Yuba River confluence (see TM 3-1). Therefore, this EFH indicator would be considered to be "at risk/not properly functioning" under existing habitat conditions.

Large Woody Material

Under existing conditions, an unknown quantity of wood currently passes through Project diversion tunnels associated with the Log Cabin and Our House Diversion Dams (see TM 6-1). In consideration of the riparian vegetation survey results and the diversion dam operations upstream, this EFH indicator would be considered to be "at risk" under existing habitat conditions.

7.3.1.2.6 Watershed Conditions (Riparian Reserves)

Under existing conditions, canopy cover in the Middle Yuba River ranged from about 15 percent to 30 percent in sites surveyed. YCWA assessed the Middle Yuba River sites as healthy because there is no indication of a lack of riparian function in these areas. One exception was the Oregon Creek Celestial Valley assessment site, which has the potential to become less healthy in the future. In this area, banks and floodplains were dominated by Himalayan blackberry under mid- and over-stories of shrubs and trees; various ages of riparian trees and shrubs were present, but few young recruits and seedlings were observed.

7.3.1.2.7 Prey Availability

The Middle Yuba River was sampled for BMI in three locations, 7.5, 8.2 and 12.5 RM downstream of Our House Diversion Dam. At the site upstream of Oregon Creek site and the downstream of Oregon Creek, low abundance limited the collection of organisms to 486 and 476 individuals per grid, respectively. These counts are just under the standard 500 organisms per grid used for IBI and MMI scoring and therefore the reliability of the calculated indices scores are considered low. IBI scores were 64, 69, and 59 from upstream to downstream, respectively. MMI scores were 62, 64, and 52 from upstream to downstream, respectively. All MMI scores were rated as 'fair' and approached a rating of 'good' which is greater than 67. Overall, prey availability may be considered to be "at risk" under existing conditions.

7.3.1.3 Yuba River Upstream of Englebright Reservoir

7.3.1.3.1 Habitat Access (Physical Barriers)

Under existing habitat conditions, the EFH in the Yuba River upstream of Englebright Reservoir is considered to be "not properly functioning" due to the presence of the Corps' 260-foot-high

Englebright Dam, which currently blocks Chinook salmon access to all available EFH in the Yuba River Watershed upstream of Englebright Dam.

7.3.1.3.2 Flow/Hydrology

Prior to the construction of New Bullards Bar Dam and Reservoir, the natural or "*unimpaired*" historic flow regime of the Yuba River upstream of Englebright Reservoir likely varied greatly in the magnitude, timing, duration, and frequency of flows, both inter-annually and seasonally. The frequency and distribution of habitat types and microhabitat features present in the Yuba River before construction of New Bullards Bar and Englebright dams, mining and other past activities were most likely substantially different from those currently found in the river.

As described above, New Bullards Bar Dam and Reservoir on the North Yuba River are used to control flood flows in the Yuba River watershed. The Project provides flood management by reducing the peak flood flow in the North Yuba River, which also results in hydrologic effects downstream in the Yuba River upstream of Englebright Reservoir. Consequently, the upstream flood control operations also have the potential to affect seasonal peak flows, channel morphology, sediment transport and EFH in the Yuba River upstream of Englebright Reservoir.

Under existing habitat conditions, EFH in the Yuba River upstream of Englebright Reservoir is currently not accessible and not occupied by managed species (i.e., Chinook salmon) due to the presence of the Corps' Englebright Dam. Therefore, it is not appropriate to analyze whether flow regimes in the Yuba River are properly functioning for Chinook salmon EFH. Instead, the analysis addresses the seasonality of flows and directional changes (increased vs. decreased) in flow that would result from implementation of the Proposed Action.

7.3.1.3.3 Water Quality

Thermal Refugia (Water Temperature)

Available monitoring data suggest that, for this EFH indicator, the Yuba River upstream of Englebright Reservoir could be considered to be "at risk" under existing habitat conditions.

Sediment/Turbidity

For this EFH indicator, the Yuba River is considered to be "properly functioning" under existing conditions because water quality sampling results indicated that sediment and turbidity are low.

Chemical Contamination/ Nutrients

Because the SWRCB identified the Yuba River upstream of Englebright Reservoir as CWA (§) 303(d) State Impaired for mercury, this EFH indicator is considered to be "at risk" under existing habitat conditions.

7.3.1.3.4 Channel Condition and Dynamics

Width/Depth Ratio

Because the average width/depth ratio for the ground-mapped reaches in the Yuba River – New Colgate Powerhouse and Middle/North Yuba River Reaches was calculated to be 16, this EFH indicator would be considered to be "not properly functioning" under existing habitat conditions. These reaches are mostly incised canyon channels that are largely bedrock controlled and, therefore, channel widths are not very responsive to changes in flows.

Streambank Conditions

The banks downstream of New Colgate Powerhouse are generally stable, mostly bedrock and boulder, with only a minor amount of bank erosion that could be due to peaking flows from the New Colgate Powerhouse. Ground-mapped data for the 1.86 miles of the Yuba River – New Colgate Powerhouse and Middle/North Yuba River Reaches did not identify any bank erosion as a percentage of the reach. Therefore, it is assumed that the banks in this reach are stable, and they would be considered to be properly functioning.

7.3.1.3.5 Habitat Elements

Substrate

The site sampled in the Yuba River upstream of the Middle Yuba River was found to have bedrock and cobble as the dominant and sub-dominate substrates, respectively. In the Yuba River downstream of the New Colgate Powerhouse, the dominant and sub-dominant substrates were found to be boulder and cobble, respectively. In the Yuba River above Colgate Powerhouse, the average percentage of cobble embeddedness was reported to be 18 percent. In the Yuba River below Colgate Powerhouse, the average percentage of cobble embeddedness was reported to be 26 percent. Based on the above, this EFH indicator is considered to be "at risk/not properly functioning" under existing habitat conditions.

Large Woody Material

In consideration of the 2012 and 2013 survey results and the operational practices upstream that do not allow for the mobilization of LWM downstream of New Bullards Bar Dam on the North Yuba River and Our House and Log Cabin diversion dams on the Middle Yuba River, this EFH indicator is considered to be "at risk" under existing habitat conditions.

7.3.1.3.6 Watershed Conditions (Riparian Reserves)

During field surveys conducted in 2011 and 2012, moderate canopy (20%) was present in the Yuba River above Colgate Powerhouse sampling site (approximately 0.6 mi upstream of New Colgate Powerhouse). The Yuba River below Colgate Powerhouse sampling site (approximately 0.6 mi downstream of New Colgate Powerhouse) also was reported to have a relatively moderate canopy (22%). Therefore, due to past watershed disturbance and the moderate canopy observed during recent surveys, this EFH indicator is assumed to be "at risk" under existing habitat conditions.

7.3.1.3.7 Prey Availability

Samples of BMI were collected in two locations on the Yuba River 7.6 and 8.8 RM. The lower site is 0.56 RM below New Colgate Powerhouse does not have an impoundment, but releases water from deep within the upstream impoundment. Sampling at the upstream location only provided 198 total organisms per grid, which is below the standard 500 organisms per grid used for IBI and MMI scoring and also represented the lowest number collected for all samples. Therefore, the reliability of the calculated indices scores are considered low. Nonetheless, IBI scores were 30 and 47 from upstream to downstream, respectively. MMI scores were 26 and 34 from upstream to downstream with subsequent ratings of 'poor' and 'fair' respectively. Therefore, prey availability could be expected to be "at risk" or approaching "properly functioning" under existing habitat conditions.

7.3.2 Yuba River Downstream of Englebright Dam

The EFH assessment approach for the lower Yuba River downstream of Englebright Dam identifies each of the stressors affecting EFH, and the manner in which these stressors affect the species' ability to utilize EFH in the lower Yuba River. The relative magnitude of each stressor was determined through consideration of the temporal occurrence, duration, spatial applicability, and species exposure and response based upon available information (see Section 6 of this EFH assessment, and Sections 5 and 6 of the Draft BA).

The key stressors and associated relative magnitudes under existing conditions (i.e., the Environmental Baseline) affecting Chinook salmon in the lower Yuba River are discussed below, and listed in **Table 7.3.2-1**. For detailed discussion of these stressors, refer to Section 6 of this EFH assessment and Sections 5 and 6 of the Draft BA.

7.3.2.1 Flow-Dependent Habitat Availability

The NMFS (2009) Draft Recovery Plan further states that "*For currently occupied habitats below Englebright Dam, it is unlikely that habitats can be restored to pre-dam conditions, but many of the processes and conditions that are necessary to support a viable independent population of spring-run Chinook salmon can be improved with provision of appropriate instream flow regimes, water temperatures, and habitat availability. Continued implementation of the Yuba Accord is expected to address these factors and considerably improve conditions in the lower Yuba River*."

As acknowledged by NMFS in this statement, stressors associated with instream flows and water temperatures in the lower Yuba River have been addressed, to the extent feasible within hydrological constraints, by the Yuba Accord. In addition, the assessment of aquatic habitat conditions Chinook salmon in the lower Yuba River and Project-related effects, previously described in Section 6.3 of this EFH assessment, used modeled lower Yuba River flows, and modeled and monitored water temperatures. Additional flow-dependent analyses in this EFH assessment used modeled flows and water temperatures to quantify spring-run and fall-run Chinook salmon spawning habitat availability, and spring-run and fall-run Chinook salmon lifestage-specific water temperature suitabilities. These considerations are summarized and presented regarding their relative magnitude as stressors to Chinook salmon in the lower Yuba River in the following table.

Table 7.3.2-1. Chinook salmon stressors and associated magnitudes in the lower Yuba River under the Environmental Baseline.

Stressor	Relative Magnitude
Flow-Dependent Habitat Availability	
Spawning Habitat	Low
Flow Fluctuations and Redd Dewatering	Low (spring-run); Low/Medium (fall-run)
Fry and Juvenile Stranding	Low/Medium
Water Temperature	Low
Narrows 2 Operations and Fish Movement	Low[1]
Passage Impediments/Barriers	
Englebright Dam	Very High
Daguerre Point Dam	Medium/High
Predation	High
Physical Habitat Alteration	
Natural River Morphology and Function	High
Floodplain Habitat Availability	Medium
Riparian Habitat and Instream Cover (riparian vegetation, instream woody material)	High

[1] Studies conducted to date indicate that adult anadromous salmonids (presumably including Chinook salmon) have not been observed entering the draft tube of Narrows 2, and Narrows 2 flow releases do not appear to adversely influence adult spring-run Chinook salmon upstream migration, holding or spawning upstream of Daguerre Point Dam. Additional information regarding this potential stressor will be available upon completion of Study 7-11a in 2014.

7.3.2.1.1 Spawning Habitat

Habitat duration analyses for both spring-run Chinook salmon and fall-run Chinook salmon spawning under the Environmental Baseline indicate that over 80 percent of maximum spawning WUA is achieved with about a 100 percent probability over the evaluated 41-year hydrologic period. There have been no definitive determinations of how much reduction in WUA would represent a stressor to specific species/lifestages. However, the use of 80 percent of maximum spawning WUA as a benchmark is based upon testimony as part of the SWRCB Mono Lake Decision 1631 process. Dr. Tom Hardy (a fisheries biologist retained by the Los Angeles Department of Water and Power (LADWP) testified that …"*no objective criteria has been validated to guide investigators on what percentage reduction in optimal habitat represents a significant impact, or at what exceedance value associated with either optimal or median habitat represents adequate protection for the aquatic resources*." However, Dr. Hardy testified that several instream flow studies that he had participated in targeted a range of 80 to 85 percent of the maximum WUA as optimal habitat conditions. Using 80 percent of maximum WUA as a benchmark, the Environmental Baseline provides optimal spring-run Chinook salmon and fall-run Chinook salmon spawning habitat conditions 100 percent of the time.

Also, the Environmental Baseline provides substantially more spring-run Chinook salmon and fall-run Chinook salmon spawning habitat than does the Without-Project scenario. The

Environmental Baseline achieves over 90 percent of spring-run Chinook salmon maximum spawning WUA with about an 87 percent probability, by contrast to the Without-Project scenario which achieves over 90 percent of maximum spawning WUA with about a 60 percent probability. For fall-run Chinook salmon, the Environmental Baseline also provides over 90 percent of maximum spawning WUA with about an 87 percent probability, while the Without-Project scenario provides over 90 percent of maximum spawning WUA with only about a 44 percent probability. Finally, Chinook salmon spawning carrying capacity under the Environmental Baseline, estimated by using two different methods, indicates that about 45,000 to 55,000 Chinook salmon redds could be accommodated in the lower Yuba River, greatly exceeding the number of Chinook salmon redds observed during the 2009 and 2010 near-census redd surveys (approximately 3,300 and 3,100, respectively) for spring-run and fall-run Chinook salmon combined.

For these reasons, flow-dependent spawning habitat availability represents a low stressor to Yuba River Chinook salmon.

7.3.2.1.2 Flow Fluctuations and Redd Dewatering

As discussed in the Draft BA, under both the Environmental Baseline and Without-Project scenarios, the potential for spring-run Chinook salmon redd dewatering is very low, averaging only about 0.07 percent annually. To put this into context, an estimated 1,148 and 1,465 spring-run Chinook salmon redds were constructed in the lower Yuba River during 2009 and 2010, respectively. Correspondingly, applying the 41-year average, it is estimated that only about 1 spring-run Chinook salmon redd would have been dewatered under either scenario during these two years. Flow-dependent redd dewatering therefore represents a low stressor to Yuba River spring-run Chinook salmon.

Specific quantitative estimation of fall-run Chinooks salmon potential redd dewatering has not been conducted. However, such estimation was conducted for steelhead in the Draft BA, and was found to represent a medium stressor due to uncontrolled flow fluctuations (uncontrolled decreases in river flows after the time of spawning). The potential for fall-run Chinook salmon redd dewatering is dependent upon whether, and to what extent, spawning would occur during uncontrolled flow conditions, particularly during December, with subsequent reductions of sufficient magnitude to expose redds and/or egg pockets to dewatering. It is reasonable to surmise that the relative magnitude of redd dewatering for fall-run Chinook salmon would be intermediate to the magnitudes for spring-run Chinook salmon and steelhead, due to intermediate exposure to uncontrolled flow conditions during the fall-run Chinook salmon spawning period. Hence, for purposes of this EFH assessment, it is assumed that redd dewatering represents a low/medium stressor to fall-run Chinook salmon.

7.3.2.1.3 Fry and Juvenile Stranding

Maximum authorized limits on controlled flow fluctuations and ramping rates are specified in RD-1644. (RD-1644, pp. 178-179, term 3.) These limitations on the controlled operations of the Narrows 2 Powerhouse are intended to protect anadromous salmonids, including Chinook salmon. Surveys conducted by YCWA indicate that Project controlled flow reductions in the fall are completed by early September and river flows then are maintained at relatively stable levels through the fall to provide stable spawning flows for spring-run and fall-run Chinook salmon and to protect redds from dewatering. These Project operations also act to minimize stranding of Chinook salmon fry, which begin to emerge from redds in November. Thereafter, flows during the winter and spring are often uncontrolled, and stranding of Chinook salmon fry can occur naturally during periods of uncontrolled runoff and spills, either through uncontrolled flow fluctuations or as runoff subsides and flows drop to controllable levels.

The probable risks to the individual organisms likely to be exposed to the stressor of fry and juvenile stranding range from medium to low, because the risk to individuals is primarily related to uncontrolled flows and the risk decreases with increasing size of growing individuals. The gravel orientation behavior of fry and juveniles is instinctual. Therefore the consequences or risks to those individuals for the populations those individuals represent from stranding when uncontrolled flow variations occur would not increase extinction risk (or reduce the probability of persistence) above the presumably protective benefits (e.g., predation avoidance) for which this behavior evolved. The current extinction risk (or probability of persistence) of those populations, and of the species that those populations comprise, must therefore be primarily due to the effects of other stressors. Consequently, due to the risk to individuals, and the context of current population size, fry and juvenile stranding likely represents a stressor of low to medium magnitude to Chinook salmon.

7.3.2.2 Water Temperature

The water temperature suitability evaluation conducted for this EFH assessment relied upon an update to a water temperature evaluation of existing conditions prepared by the RMT in 2010 and 2013, and is consistent with the evaluation conducted for spring-run Chinook salmon in the BA prepared for the Proposed Action. The evaluation conducted in this EFH assessment examined exceedance probabilities of lifestage-specific water temperature index values, for both spring-run and fall-run Chinook salmon, using water temperature monitoring data from October 2006 through June 2013 and the Project Relicensing daily water temperature model simulations for the period extending from WY 1970-2010.

The RMT (2010) concluded that implementation of the Yuba Accord provides a suitable thermal regime for target species in the lower Yuba River, and did not recommend water temperature-related operational or infrastructure modifications at that time. Updated evaluations included in the RMT (2013) Monitoring and Evaluation report came to the same conclusion, and also did not recommend water temperature-related operational or infrastructure modifications. This EFH assessment updated the evaluations and supported the previous conclusions in RMT (2010) and RMT (2013) for both spring-run and fall-run Chinook salmon. Consequently, this EFH assessment concludes that water temperatures represent a low stressor to Chinook salmon. As previously discussed, NMFS (2009) also recognized that water temperature regimes have been greatly improved by implementation of the Yuba Accord.

7.3.2.3 Narrows 2 Operations and Fish Movement

Project FERC relicensing studies (Technical Memorandum 7-11) conducted to date indicate that adult anadromous salmonids (presumably including Chinook salmon) have not been observed entering the draft tube of Narrows 2. Additional analyses regarding Narrows 2 operations and fish movement prepared for this BA indicate that Narrows 2 flow releases do not appear to adversely influence adult Chinook salmon upstream migration, holding or spawning upstream of Daguerre Point Dam. At this time, Narrows 2 operations can be characterized as representing a low stressor to Chinook salmon. However, additional information regarding Narrows 2 operations as a stressor will be available when additional specific studies are completed during 2014.

7.3.2.4 Passage Impediments/Barriers

7.3.2.4.1 Englebright Dam

Englebright Dam presents an impassable barrier to the upstream migration of anadromous salmonids, and marks the upstream extent of currently accessible Chinook salmon habitat in the lower Yuba River. According to NMFS (2007, 2009), the greatest impact to listed anadromous salmonids in the Yuba River watershed is the complete blockage of access for these species to their historical spawning and rearing habitat above Englebright Dam. Because of the loss of historical spawning and rearing habitat above Englebright Dam, resultant loss of reproductive isolation and subsequent hybridization between spring-run and fall-run Chinook salmon, restriction of spatial structure and associated vulnerability to catastrophic events, the existence of Englebright Dam represents a very high stressor to Yuba River Chinook salmon.

7.3.2.4.2 Daguerre Point Dam

Given the entire suite of considerations associated with the design configuration and features of Daguerre Point Dam and its associated fish ladders that reportedly could either delay or impede adult upstream migration, as well as issues identified regarding juvenile downstream passage, the effects associated with the presence of Daguerre Point Dam likely represent a medium to high stressor to Yuba River Chinook salmon under the Environmental Baseline.

Predation

The extent of predation on juvenile Chinook salmon in the lower Yuba River is not well documented. Although predation is a natural component of salmonid ecology, it has been suggested that in addition to native predators, the rate of predation of salmonids in the lower Yuba River has potentially increased through the introduction of non-native predatory species such as striped bass, largemouth bass and American shad, and through the alteration of natural flow regimes and the development of structures that attract predators (NMFS 2009).

This stressor includes the predation associated with increases in predator habitat and predation opportunities for piscivorous species created by major structures and diversions, and predation resulting from limited amounts of prey escape cover in the lower Yuba River. Consequently, predation of juvenile salmonids by introduced and native piscivorous fishes occurs throughout the lower Yuba River potentially at relatively high rates. Therefore, predation likely represents a high stressor to the juvenile lifestage of Yuba River Chinook salmon.

Natural River Morphology and Function

From a floodplain meander perspective, braided channels, side channels, and channel sinuosity are created through complex hydraulic-geomorphic interactions. Attenuated peak flows and controlled flow regimes emanating from the upper Yuba River watershed, and the influence of gravel berms along portions of the lower Yuba River, have affected the natural meandering of the lower Yuba River in the Action Area. The loss of natural river morphology and function is the result of river channelization and confinement, which leads to a decrease in riverine habitat complexity, and thus to a decrease in the quantity and quality of adult and juvenile anadromous salmonid habitat. This is a particularly operative stressor affecting juvenile anadromous salmonid rearing habitat availability.

Thus, restricted availability of complex, diverse habitats such as multiple braided channels and side channels associated with the loss of natural river morphology and function presently continues to represent a relatively high stressor to Yuba River Chinook salmon under the Environmental Baseline.

Floodplain Habitat Availability

Floodplain habitat, as considered in this section of the EFH assessment, is narrowly focused on the inundation of floodplain habitat and associated effects on juvenile salmonid rearing. In consideration that this stressor primarily addresses one lifestage, that inundation of floodplain habitat occurs relatively frequently compared to other Central Valley streams, that inundation of floodplain habitat would not necessarily occur each year even under unaltered hydrologic conditions, and that the lower Yuba River floodplain is comprised of unconsolidated alluvium without an abundance of characteristics associated with increased juvenile salmonid growth, floodplain habitat availability likely represents a medium stressor to Yuba River juvenile Chinook salmon.

Riparian Habitat and Instream Cover (Riparian Vegetation, Instream Woody Material)

In consideration of the importance that riparian vegetation and LWM play in the habitat complexity and diversity, which potentially limits the productivity of juvenile salmonids, the abundance and distribution of these physical habitat characteristics in the lower Yuba River, and the fact that the present availability of riparian habitat and instream cover (in the form of LWM) is a stressor that is manifested every year, it represents a stressor of relatively high magnitude to Yuba River juvenile Chinook salmon.

7.4 Potential Effects of the Proposed Action on EFH in the Action Area

The Proposed Action includes both construction-related activities and operations-related changes, and a detailed description of the Proposed Action is provided in Section 4 of this EFH assessment. YCWA proposes to add the following components to the Project facilities, each of which will require some level of construction activity.

For all temporary construction activities related to all proposed measures, potential effects to aquatic habitat (i.e., EFH) have been evaluated and addressed in the DLA (see Section 3.0 of Exhibit E). Anticipated effects to aquatic resources and EFH resulting from the construction of new facilities are summarized below.

- New Bullards Bar Dam Flood Control Outlet. Construction of the New Bullards Bar Reservoir flood control outlet would require excavation in the upper left abutment area of the New Bullards Bar Dam site. Erosion control measures will be in place to minimize any potential delivery to aquatic resources and effects are expected to be minimal. In addition YCWA will implement its Erosion and Sediment Control Plan under proposed Condition GS1, which will minimize disturbance and potential transport of sediment to an active channel. YCWA will implement its Hazardous Materials Management Plan (WR1). YCWA will also obtain all necessary permits and approvals for the work, including FERC's approval. The effects of construction of the outlet are expected to be insignificant, local (the area is in a remote location), and short term. Similarly, potential effects during operation, which may include increased turbidity when the outlet is first used, will be short-term and minor, because it will occur when river flows are high.
- New Colgate Powerhouse Tailwater Depression System. Construction of the TDS will not require borrow areas because the work will not entail significant earthwork. All work will be confined to the powerhouse, yard and immediate vicinity. No undisturbed areas are anticipated to be affected as a result of the work, so effects on sediment availability and erosion are expected to be minimal. In addition YCWA will implement its Erosion and Sediment Control Plan under proposed Condition GS1, which will minimize disturbance and potential transport of sediment to an active channel. YCWA will implement its Hazardous Materials Management Plan (WR1). YCWA will also obtain all necessary permits and approvals for the work, including FERC's approval. The effects of construction of the TDS is expected to be insignificant, local (the area is in a remote location), and short term.
- Enhancements to Project Recreation Facilities. Reconstruction and rehabilitation of existing facilities have the potential to affect sediment availability and, if sediment is delivered to active channel, sediment deposition or transport, or changes to water quality could affect aquatic resources. Implementation of YCWA's Erosion and Sediment Control Plan under proposed Condition GS1, Hazardous Materials Management Plan (WR1), and the terms and conditions to all appropriate permits and approvals will protect aquatic resources.

Potential effects resulting from the construction of new facilities are not anticipated to adversely affect EFH in the Yuba River Watershed. All flow and water temperature-related potential effects to EFH, and indicators of properly functioning habitat conditions in the Yuba River Watershed upstream of Englebright Dam, are discussed by specific location below.

7.4.1 Yuba River Watershed Upstream of Englebright Dam

7.4.1.1 North Yuba River (New Bullards Bar Dam Reach)

7.4.1.1.1 Habitat Access (Physical Barriers)

Four structures were identified as potential passage barriers/impediments to resident trout in the North Yuba River under existing habitat conditions. While the identified trout passage barriers may or may not be of a size sufficient to also present a barrier to Chinook salmon (if able to be present), the Corps' 260-foot-high Englebright Dam currently blocks Chinook salmon access to all available EFH in the North Yuba River. Consequently, for this indicator (i.e., habitat access), the EFH in the North Yuba River is considered to be "not properly functioning" under the baseline due to the presence of the Corps' Englebright Dam. Because the Proposed Action would not affect fish passage conditions at Englebright Dam, there would be no change to the current lack of access to EFH in the North Yuba River as a result of the Proposed Action.

7.4.1.1.2 Flow/Hydrology

In general, the frequencies and magnitudes of river flows can strongly influence substrate and channel morphology conditions, as well as the amount of spawning and rearing areas available for salmon. Lower streamflows are more susceptible to seasonal water temperature extremes during both winter and summer (NMFS 1996).

Flow releases from New Bullards Bar Dam directly affect the 2.4-mile section of the North Yuba River from the New Bullards Bar Dam downstream to the North Yuba River's confluence with the Middle Yuba River. The existing Project FERC license requires year-round minimum flows of 5 cfs for the maintenance of fish life in the North Yuba River below New Bullards Bar Dam.

In the 2.4 mile reach downstream of New Bullards Bar Dam, flow conditions for the Proposed Action were developed by YCWA, in part, to augment minimum flows released from Our House and Log Cabin diversion dams to maximize rainbow trout spawning and adult habitat availability in the 5.7 mile long Yuba River reach from the North and Middle Yuba River confluence to the New Colgate Powerhouse (see Section 3.3.03 in the DLA). Increased minimum flows under the Proposed Action would reduce water temperatures in the reach between New Bullards Bar Dam and the confluence with the Middle Yuba River. Minimum flows under the Proposed Action would vary by water year type. The proposed minimum flows would be 5 cfs from April 1 through June 30 each year, and would generally exceed 5 cfs during the remaining months of any water year, except during "extreme critically dry" water years. A sensitivity analysis performed using the water temperature models indicates that a minimum flow in excess than 200 cfs would be required to maintain water temperatures below 20.0°C (68°F) immediately upstream of New Colgate Powerhouse. YCWA is not proposing such a minimum flow.

Habitat time series results, typically conducted in the form of habitat exceedance (i.e., duration) analyses, were used to evaluate fish habitat availability over time (Waddle 2001). Trends in evaluated species (e.g., rainbow trout) and lifestage habitat duration results followed seasonal flow patterns or powerhouse operations. The rainbow trout adult lifestage displayed a positive relationship to increased flows during the winter and spring while habitat availability was reduced during the summer and early fall.

In general, flow-related benefits (e.g., increased habitat availability, slightly cooler water temperatures) to resident trout associated with increased monthly releases from New Bullards Bar Dam under the Proposed Action, particularly during the summer and fall, also would be expected to improve flow-related conditions for EFH in the North Yuba River.

7.4.1.1.3 Water Quality

Thermal Refugia (Water Temperature)

YCWA's 2008 through 2012 water temperature monitoring occurred at two locations: (1) RM 2.3, immediately below New Bullards Bar Dam (July 2008 through October 2012); and (2) RM 0.1, immediately upstream of the Middle Yuba River confluence (July 2008 through October 2012). At RM 2.3, the mean and maximum daily water temperatures during July were 10.2°C and 11.7°C, respectively, and mean and maximum daily water temperatures in August were 10.3°C and 11.9°C, respectively. Mean daily water temperatures never exceeded 20°C. At RM 0.1, mean and maximum daily water temperatures during July were 21.6°C and 23.9°C, respectively, and mean and maximum daily water temperatures in August were 20.5°C and 23.5°C, respectively. Mean daily water temperature exceeded 20°C (68°F) during July and August 90 percent and 76 percent of the time, respectively. As previously described, North Yuba River water temperature monitoring results from 2009 through 2012 show that water temperatures often exceeded the upper tolerance WTI of 68°F for Chinook salmon adult immigration and staging, as well as the 65F° upper tolerance WTI for Chinook salmon juvenile rearing during the summer. Consequently, available data suggest that this EFH indicator (i.e., thermal refugia) could be considered "at risk" or "not properly functioning" under the baseline (i.e., existing habitat conditions).

While a substantial quantity of water temperature data was collected throughout the Action Area, data was collected only during a few years, and generally only at readily accessible locations. The analysis of potential effects was enhanced through the examination of a longer period-of-record of data than was historically available, which is representative of a wide range of hydrologic and meteorological conditions. As described in Section 3.3.02 of the DLA, a suite of water temperature models were developed with the capability of simulating water temperatures throughout the Action Area.

Increased minimum flows downstream of New Bullards Bar Dam would result in simulated average daily water temperatures that would be the same or colder throughout this reach under the Proposed Project Alternative (Proposed Action) than those that would occur under the No Action Alternative (existing conditions) habitat conditions (Table 7.4.1-1). However, water temperatures at the upper end of this reach are dependably cold throughout the year and represent an existing limited thermal refugia.

Table 7.4.1-1. Comparison of simulated mean monthly water temperatures in the North Yuba River upstream of the Middle Yuba River Confluence under the No Action Alternative (existing conditions) and the Proposed Project Alternative (Proposed Action) for water years 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change[1]		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	7.9	12.2	16.4	7.3	10.4	14.8	0.6	1.8	1.5
November	6.1	9.4	13.2	6.3	8.6	11.7	-0.2	0.8	1.5
December	5.4	8.0	12.1	5.7	7.7	12.0	-0.3	0.3	0.2
January	5.6	8.0	12.3	5.7	7.7	11.1	-0.1	0.3	1.2
February	5.9	9.2	13.0	5.9	8.4	11.3	-0.1	0.8	1.7
March	6.0	10.7	14.6	6.0	9.5	13.3	-0.1	1.3	1.4
April	6.2	13.1	18.8	6.3	13.0	18.0	0.0	0.1	0.9
May	6.4	15.3	22.4	6.5	15.2	21.8	0.0	0.1	0.6
June	6.5	17.2	22.8	6.7	17.1	22.5	-0.2	0.1	0.3
July	7.6	19.2	24.3	7.6	15.3	21.0	0.0	3.9	3.3
August	13.7	17.8	22.5	11.0	14.4	19.7	2.7	3.5	2.8
September	11.1	15.4	20.0	9.5	12.7	18.3	1.6	2.7	1.8

[1] A positive value indicates cooler water temperatures under the Proposed Action relative to existing conditions.

During the summer (July through September), mean monthly water temperatures would be between 2.7° to 3.9 °C cooler under the Proposed Action, which would be expected to provide more suitable EFH, relative to existing habitat conditions.

7.4.1.1.4 Sediment/Turbidity

Sediment sources include bank erosion, surface erosion, debris flows, side channel development, historic spill channel erosion, and current and historic mining debris. It is assumed that New Bullards Bar Dam traps all upstream sources of sediment. The North Yuba River channel is comprised of coarse bed and banks resistant to movement, with storage of sediment in small areas in deep pools, in velocity shadows, and on lateral bars. Mid-channel bars are uncommon, but they exist in every one of the reaches, though whether or not they have been reduced in size or frequency since dam construction is unknown. The Basin Plan requires that waters be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. This objective is expressed in terms of changes in turbidity (NTU) in the receiving water body: where natural turbidity is 0 to 5 NTUs, increases shall not exceed 1 NTU; where 5 to 50 NTUs, increases shall not exceed 20%; where 50 to 100 NTUs, increases shall not exceed 10 NTUs; and where natural turbidity is greater than 100 NTUs, increase shall not exceed 10 percent. Results of water quality sampling during 2012 found that turbidity in the North Yuba River was low. Overall, for this EFH indicator (i.e., sediment/turbidity), the North Yuba River is considered to be "properly functioning" under existing habitat conditions because sediment and turbidity are low.

The Proposed Action affects flood flows capable of transporting large amounts of sediment and large sizes of sediment materials. New Bullards Bar Dam and Reservoir were designed for flood control purposes, and spills are controlled so sediment-moving flows are reduced. However, the large sizes of substrate materials in the bed and banks of the North Yuba River below New

Bullards Bar Dam and the lack of deformable substrates are such that sediment transport is likely to be unchanged and to continue to be minor under the Proposed Action. Therefore, the Proposed Action is not anticipated to adversely affect EFH based on potential changes to this indicator.

Chemical Contamination/Nutrients

Water quality in the North Yuba River above the Middle Yuba River was sampled approximately 2.0 miles downstream of New Bullards Bar Dam. A review of historic water quality data (YCWA 2010) suggests that surface water quality in the Action Area generally meets Basin Plan Objectives. To supplement the historical data regarding general water quality conditions, YCWA undertook the FERC-approved Study 2.3, Water Quality, and results for the North Yuba River are summarized in Table 7.4.1-2. YCWA's study data are consistent with historic study data. Within and between seasons, water is of a high quality in the Action Area. YCWA also found that most analytes were reported at non-detectable to just above reporting limit concentrations. The water is generally clear (i.e., average turbidity of <36 NTU), and DO levels are near saturation. Alkalinity is low (<100 mg/L in all samples) and pH is near neutral.

The SWRCB has identified the North Yuba River from New Bullards Bar Dam to the confluence with the Middle Yuba River as Clean Water Act Section 303(d) State Impaired for mercury. However, this listing was based on fish tissue concentration data, rather than on surface water concentration data (SWRCB 2010). Mercury in the Yuba River Basin is a legacy of the region's gold mining history. Mercury can affect the nervous system of higher trophic organisms and is bioaccumulated and transferred to higher trophic organisms through the food-web. The presence of methylmercury in surface water suggests that it may be bioaccumulating, because methylmercury is thought to be mercury's most bioavailable form. For this reason, this EFH indicator (i.e., chemical contamination/nutrients) for the North Yuba River is considered to be "at risk" under existing aquatic habitat conditions. Relative to existing aquatic habitat conditions, there would be no change to this EFH indicator as a result of the Proposed Action.

7.4.1.1.5 Channel Condition and Dynamics

Width/Depth Ratio

NMFS (1996) considered a properly functioning width/depth ratio to be less than 10, an at risk ratio to be 10 to 12, and a not properly functioning ratio to be greater than 12. The average width/depth ratio for the ground-mapped reaches in the New Bullards Bar Reach of the North Yuba River is 20. Therefore, according to NMFS (1996), this EFH indicator (i.e., width/depth ratio) would be considered to be "not properly functioning" under the baseline (i.e., existing aquatic habitat conditions).

As part of the Proposed Action, YCWA proposes to increase minimum flows from New Bullards Bar Dam into the North Yuba River from 5 cfs to the 5 to 13 cfs range, depending on water year type. It is unlikely that the Proposed Action would have the potential to substantively change width/depth relationships in the North Yuba River. Therefore, relative to existing aquatic habitat conditions in the North Yuba River, there would not be any substantive changes to this EFH indicator as a result of the Proposed Action.

Table 7.4.1-2. Summary of North Yuba River water quality data downstream of New Bullards Bar Reservoir (see Technical Memorandum 2-3 for complete results).

			North Yuba River		North Yuba River	
Analyte	**Benchmark**	***Sample Location***	**Below New Bullards Bar Dam at Wier**		**Below New Bullards Bar Dam at Wier**	
		Date	**6/6/2012**		**8/29/2012**	
		Units	**Result**	**Notes**	**Result**	**Notes**
latitude/longitude			659815	4361801	659832	4361793
In Situ Measurments						
Stream Flow[b]	--	cfs	3000		--	
Temperature	--	°C	8.3		9.0	
Specific Conductance	900	µSiemans/cm	62		69	
pH	6.5-8.5	stnd units	8.1		7.6	
Dissolved Oxygen	< 7 mg/L	mg/L	10.6		9.7	
Turbidity	--	NTU	4.2		2.2	
Basic Water Quality						
Alkalinity, Total (as CaCO3)	20	mg/L	33		34	
Ammonia (as N)	Temp & pH Dep't	mg/L	0.1	ND	0.1	ND
Hardness, Total	--	mg/L	30		29	
Nitrate (as N)	10	mg/L	0.055	J	0.1	ND
Nitrite (as N)	1	mg/L	0.1	ND	0.1	ND
o-Phosphate (as P)	--	mg/L	0.1	ND	0.1	ND
Phosphorus, Total	--	mg/L	0.092	J	0.06	J
Solids, Total Dissolved	500	mg/L	47		23	
Solids, Total Suspended	--	mg/L	1	ND	1	ND
Total Kjeldahl Nitrogen	--	mg/L	0.5	ND	0.5	ND
Total Metals Concentrations						
Arsenic	10	µg/L	0.52		0.48	
Cadmium	5	µg/L	0.003	J	0.02	ND
Copper	1000	µg/L	0.43		0.42	
Lead	15	µg/L	0.023	J	0.010	J
Mercury	50	ng/L	0.77		0.68	
Methyl Mercury	--	ng/L	0.05	ND	0.05	ND
Dissolved Metals Concentrations						
Arsenic	--	µg/L	0.51		0.47	
Cadmium	Hardness Dep't	µg/L	0.02	ND	0.02	ND
Copper	Hardness Dep't	µg/L	0.39		0.41	
Lead	Hardness Dep't	µg/L	0.006	J	0.04	ND
Methyl Mercury	--	ng/L	0.05	ND	0.05	ND
NOTES						
B - Analyte was prsent in the associated method blank; J - Analyte was detected at a concentration below the reporting limit and above the laboratory method detection limit. Reported value is estimated; 'ND - Analyte included in the analysis, but not detected at the reporting limit.						

7.4.1.1.6 Streambank Conditions

NMFS (1996) considered streambank conditions to be properly functioning if greater than 90 percent of the bank is stable (i.e., less than 10% of the banks are actively eroding). At risk indicates that 80-90 percent of the banks are stable, and not properly functioning indicates that less than 80 percent of the banks are stable.

The North Yuba River is mostly laterally and vertically stable (e.g., there is little likelihood of large-scale plan-form change or incision). The channel is characterized by large substrate, steep gradients, vertical confinement, low bank erodibility, and low fine sediment accumulation. Ground-mapped data for the 2.3 miles of the North Yuba River did not identify any bank erosion as a percentage of the reach. Therefore, it is assumed that the banks in this reach are stable and, according to the NMFS (1996) criteria, it is properly functioning.

Under the Proposed Action, effects on channel stability would not be expected because most of the reaches are transport-dominated (i.e., few response reaches), and channels are resistant to further change. The majority of stream reaches affected by the Project are stable transport reaches where the capacity of the channel to move sediment is greater than the amount of sediment entering the channel. YCWA does not propose any changes to the Project or its operations that would have a significant effect on overall channel stability or the nature of the transport reaches. Relative to existing aquatic habitat conditions in the North Yuba River, there would be no change to this EFH indicator as a result of the Proposed Action.

7.4.1.1.7 Habitat Elements

Substrate

NMFS (1996) and PFMC (1999) identified properly functioning substrate conditions to include gravel or cobble as the dominant substrate with clear interstitial spaces, or less than 20 percent embeddedness. Embeddedness ranges between 20-30 percent in gravel/cobble dominated substrate were considered at risk. Dominant substrates (e.g., bedrock, sand, silt) or embeddedness over 30 percent in gravel/cobble were considered not properly functioning.

As described in TM 3-8, habitat in a 373-feet long site in the North Yuba River upstream of the Middle Yuba River was sampled, and cobble and boulder were the dominant and sub-dominate substrates, respectively. Survey results report that this site was absent of suitable sized spawning gravel for resident trout. Although average pool tail-out embeddedness (%) was not reported for the New Bullards Bar Reach of the North Yuba River, cobble embeddedness was estimated to the nearest 5 percent in Study 3-1 by visually inspecting the cobble to determine the percent that was buried by fine particles. In the North Yuba River above the Middle Yuba River, the average percent cobble embeddedness was reported to be 21 percent. Therefore, this EFH indicator (i.e., substrate) would be considered to be “at risk” under existing aquatic habitat conditions. Relative to existing aquatic habitat conditions, the Proposed Action would not be expected to substantively change this EFH indicator.

Large Woody Material

LWM provides cover, velocity refugia, and can play an important role in the geomorphic processes of a river by changing the localized hydraulics around wood, which can lead to pool formation and the maintenance of channel complexity (Bisson et al. 1987). LWM also aids in reducing channel erosion and buffering sediment inputs by providing sediment storage in headwater streams (NMFS 1996).

In the New Bullards Bar Reach of the North Yuba River, LWM (defined as one log in the diameter class 12 to 24 inches, length class 25 to 50 feet, within the wetted channel) was rarely reported. Smaller size classes of LWM were not evenly distributed throughout the reaches surveyed, and the average volume (m^3) of LWM per 100 meters in the North Yuba River was reported to be 6.7 m3 per 100 m average. YCWA described the quantity of LWM observed in study sites, but did not estimate the annual volume of wood passing over Project facilities (no longer available to downstream reaches). These baseline conditions may be due, at least in part, to the fact that LWM that accumulates in New Bullards Bar Reservoir is gathered annually and is burned every 1 to 3 years, after the appropriate permits are obtained.

Study 6.1 indicates that a LWM budget will be developed using information regarding estimates of the annual volume of LWM trapped in reservoirs (e.g., New Bullards Bar). However, in consideration that unobstructed downstream movement of LWM is currently restricted, this EFH indicator (i.e., substrate) would be considered to be “at risk” under the existing aquatic habitat conditions. Relative to existing aquatic habitat conditions, the Proposed Action would not be expected to adversely affect this EFH indicator.

7.4.1.1.8 Watershed Conditions (Riparian Reserves)

Healthy riparian areas have many characteristics including diverse plant species that provide cover and shade, water storage capacity and constant stream flow, vertical stream banks, and habitat for diverse wildlife species (OSU 2013). In well-developed riparian areas, the riparian tree species contribute LWM to the stream bank and channel, which adds to aquatic and terrestrial habitat complexity and organic content, providing a positive feedback loop that supports sediment capture and riparian growth (Naiman et al. 2005). According to NMFS (1996), “properly functioning” riparian habitat provides adequate shade, LWM recruitment, habitat protection and connectivity, and buffers or refugia for sensitive aquatic species (>80% intact).

YCWA collected a variety of quantitative information and qualitative observations regarding the riparian communities in Project-affected reaches to assess the current conditions of riparian habitats. Existing information regarding riparian habitat in the area is limited.

The riparian sites assessed by YCWA in Study 6-1 were found to support woody species in various lifestages, including mature trees, recruits (i.e., saplings) and seedlings, although the abundance of each often depended on the dominant substrates of the site (see Section 3.3.04 of the DLA). In the North Yuba River, there was no visible change in riparian vegetation from earliest available photos (i.e., 1937 or 1939, depending on site) to 2009. Canopy cover at North Yuba River sites sampled for BMI was reportedly 7 percent, and the lack of riparian vegetation may be a factor contributing to the overall low BMI scores in this reach (see TM 3-1). Additionally, field survey efforts determined that, although riparian vegetation is limited, most stream reaches in the North Yuba River were healthy because there is no indication of a lack of riparian function in these areas. YCWA evaluated most stream reaches as healthy because recruits of woody vegetation and a variety of age classes were present in all stream reaches, indicating that germination is occurring under current Project operation and lateral distribution of woody species is within the expected range, with willows near the wetted edge and other hardwood species occurring farther upslope (Harris and McBride 2013).

At the assessment site at the North Yuba River upstream from the confluence with the Middle Yuba River, under current Project O&M, the riparian vegetation appears healthy. Field observations indicated that the majority of the woody species were willows and were present upslope of bankfull, within floodprone areas. Willows have a high tolerance for anaerobic conditions and a medium tolerance to drought; the moisture conditions are suitable for willows and some alders at this lateral distribution. The moisture regime in this area may be supported by fines that provide capillary fringe, but it was difficult to obtain direct observations of this because of the massive boulders blocking the view to the rooting substrate. Woody species may not be present closer to the wetted edge because supporting fines may not be present, inundation of substrate conditions may be too high or continuously long, or the velocity of high flows may prevent establishment.

Two proposed aquatic resource conditions have the potential to have a beneficial effect on riparian vegetation. Condition AR1, *Maintain Minimum Streamflows Below Our House Diversion Dam, Log Cabin Diversion Dam, and New Bullards Bar Dam*, provides stabilized flows at levels similar to or higher than current flows on the Our House Diversion Dam Reach and the Log Cabin Diversion Dam Reach, providing conditions for riparian growth along the streamside. The effects of the condition in New Bullards Bar Dam will have a less than significant effect on riparian vegetation in the North Yuba River, as the minimum flows will remain about the same during the riparian growing season. In summary, the Proposed Action would be expected to maintain flow-related conditions for this EFH indicator (i.e., riparian habitat) in the North Yuba River, relative to existing habitat conditions.\

7.4.1.1.9 Prey Availability

BMI samples were collected at one site in the North Yuba River approximately 2.0 RM downstream of New Bullards Bar Dam near the confluence with the Middle Yuba River. Sampling at the location resulted in 325 total organisms per grid, which is below the standard minimum of 500 organisms per grid used for IBI and MMI scoring. Therefore, the reliability of the calculated indices scores are low. Nonetheless, the IBI score was 21 and MMI was 16 and classified per MMI standards as in poor condition.

Habitat in some locations was not conducive to high abundance of BMI, especially within the North Yuba River where large, granitic boulders dominate the stream, leaving less surface area for BMI. Lower scores in these locations appeared to be primarily driven by the existing habitat, and not by other external factors or conditions.

Under the Proposed Action, proposed conditions that may be beneficial to mollusks and BMI include the minimum streamflow measures AR1, and implementation of an Aquatic Invasive Species Management Plan under Condition AR5. Over the long-term, the proposed flow changes under the Proposed Action would be expected to augment the existing hydrologic regime, which would maintain, or could potentially provide a slight benefit to the existing macroinvertebrate communities in the North Yuba River.

7.4.1.2 Middle Yuba River (with emphasis on the ~1.5 miles of EFH upstream from the confluence of the Middle Yuba River and the North Yuba River)

7.4.1.2.1 Habitat Access (Physical Barriers)

Under existing habitat conditions, two structures were identified as potential passage barriers/impediments to resident trout in the Middle Yuba River. While the identified trout passage barriers may or may not be of a size sufficient to also present a barrier to Chinook salmon, the Corps' 260-foot-high Englebright Dam currently blocks Chinook salmon access to all available EFH in the Yuba River Watershed upstream of Englebright Dam. Consequently, for this indicator (i.e., habitat access), the EFH in the Middle Yuba River is classified as "not properly functioning" under the baseline due to the presence of the Corps' Englebright Dam. Because the Proposed Action would not change fish passage conditions at Englebright Dam, there would be no change to the current lack of access to EFH in the Middle Yuba River as a result of the Proposed Action.

7.4.1.2.2 Flow/Hydrology

Flow releases from Our House Diversion Dam directly affect the 22.3-mile section of the Middle Yuba River from Our House Diversion Dam downstream to the confluence of the Middle Yuba River and the North Yuba River. Releases made at Log Cabin Diversion Dam on Oregon Creek join with releases made at Our House Diversion Dam on the Middle Yuba River affecting the remaining 4.7 miles of the Middle Yuba River down to the confluence with the North Yuba River.

Downstream of Our House Diversion Dam, flow conditions were developed by YCWA, in part, to augment minimum flows released from Our House and Log Cabin diversion dams to maximize rainbow trout spawning and adult habitat availability. Minimum flows under the Proposed Action would vary by water year type. YCWA proposes to increase minimum flow releases from: 1) Our House Diversion Dam into the Middle Yuba River from 21-50 cfs to 21-80 cfs, depending on water year type; and 2) from Log Cabin Diversion Dam into Oregon Creek from 5.6-12 cfs to 6-31 cfs, depending on water year type.

Habitat time series results are used to evaluate fish habitat availability over time. Trends in evaluated species (e.g., rainbow trout) and lifestage habitat duration results followed seasonal flow patterns or powerhouse operations. To evaluate the resultant flows of Condition AR1 over time, YCWA calculated the amount of habitat that would be achieved under YCWA's Proposed Project flows, relative to existing conditions.

Proposed Action releases at Our House Diversion Dam that targeted rainbow trout adult and spawning lifestages, resulted in both increases and decreases in habitat for all rainbow trout lifestages. While some habitat reductions were observed, significant improvements were made to the adult lifestage. Habitat for rainbow trout adult and spawning lifestages increased in all months except May, when average monthly flows exceed discharge values associated with optimal WUA.

In general, flow-related benefits (e.g., increased habitat availability, slightly cooler water temperatures) to resident trout associated with increased monthly releases from Our House Diversion Dam and Log Cabin Diversion Dam under the Proposed Action, particularly during the summer and fall, also would be expected to improve flow-related conditions for EFH in the Middle Yuba River.

7.4.1.2.3 Water Quality

Thermal Refugia (Water Temperature)

As previously described, Middle Yuba River water temperature monitoring results from 2009 through 2012 show that maximum daily average water temperatures frequently exceed the upper tolerance WTI of 68°F for Chinook salmon adult immigration and staging, as well as the 65F° upper tolerance WTI for Chinook salmon juvenile rearing during the summer. Consequently, available data suggest that, for this EFH indicator (i.e., thermal refugia), the Middle Yuba River could be considered to be "at risk" or "not properly functioning" under the baseline.

In the reach downstream of the Middle Yuba and Oregon Creek confluence, the Proposed Action would not adversely affect resident fish (i.e., rainbow trout) due to increases in water temperature. Increased minimum flows are not expected to reduce Middle Yuba River water temperatures below 20.0°C because historical inflow to Our House Diversion Dam are above 20.0°C (Table 7.4.1-3), and there is no cold water storage in the Our House Diversion Dam impoundment.

Table 7.4.1-3. Comparison of Simulated Mean Monthly Water Temperatures in the Middle Yuba River upstream of the North Yuba River (Our House Diversion Dam Reach), for the No Action Alternative and Proposed Project Alternative, for Water Years 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change[1]		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
January	0.6	4.0	7.0	0.6	4.0	6.7	0.0	0.0	0.2
February	0.9	6.0	9.3	1.1	5.9	7.0	-0.2	0.1	2.3
March	5.5	8.9	13.3	5.5	8.6	8.7	0.0	0.3	4.6
April	5.7	11.9	17.6	5.7	11.5	11.7	0.0	0.4	5.8
May	7.0	15.5	23.9	7.0	15.0	16.5	0.0	0.5	7.4
June	11.5	21.0	27.4	11.5	20.3	21.9	0.0	0.7	5.5
July	19.4	25.6	28.7	19.0	25.1	28.1	0.4	0.5	0.7
August	19.5	24.0	28.0	19.4	23.8	27.5	0.1	0.2	0.5
September	15.2	20.2	24.7	15.4	20.1	24.6	-0.2	0.1	0.1
October	6.8	14.0	24.0	6.8	13.9	17.4	0.0	0.1	6.6
November	2.4	7.3	12.3	2.5	7.3	10.6	-0.1	0.0	1.8
December	0.0	4.0	7.5	0.0	4.0	7.2	0.0	0.0	0.3

1 A positive value indicates cooler water temperatures under the Proposed Action.

Overall, as shown above and more fully described in Section 3.3.03 of the DLA, the Proposed Action would not adversely affect resident fish due to changes in Middle Yuba River water temperatures. Similarly, compared to existing aquatic habitat conditions, the Proposed Action would not be expected to adversely affect EFH (i.e., thermal refugia), or reduce the available area of usable EFH in the Middle Yuba River.

Sediment/Turbidity

The Middle Yuba River has a coarse and resistant bed and banks in most of its length, with few possibilities of lateral or vertical shifting. Locations on the upstream side of bends and within and downstream of long-term depositional areas are more alluvially dominated, but sediment transport is still very high and particles move with fairly high frequency. Sediment is available to the channel and being transported at a higher rate than it is replaced.

Our House and Log Cabin diversion dams create channel storage reservoirs of stored sediment. The areal extent of the Our House Diversion Dam deposit is approximately 11.4 acres; deposits were described by Stillwater Sciences (2013) as mostly coarse sediment (cobble, gravel, and sand), and a small amount of finer sediment stored within the low water pool. The areal extent of the Log Cabin Diversion Dam deposit is approximately 3 acres. Sediment has been removed from Our House Diversion Dam impoundment on several occasions, usually in response to large storm events that delivered the bulk of the sediments (EBASCO and Envirosphere 1986). In 1986, 1992, 1997, and again in 2006, excavation operations by YCWA within the impoundment were conducted to clear sediment away from the valve structures on the dam and diversion intake. There are no reliable estimates of sediment removed or passed below Log Cabin Diversion Dam.

Stillwater Sciences (2013) found evidence that shear stresses are likely too high below Our House Diversion Dam to retain material that is stored upstream by Our House. The surface grain size distribution in pool tails (a depositional area) below Our House is generally coarser than delta deposits upstream of Our House. However, the more mobile sediment that is stored in pool margins and in velocity shadows of obstructions downstream of Our House has a size distribution very similar to deposits upstream of Our House. This suggests that mobile material, such as is currently stored upstream of, and available downstream, of Our House, will be stored in deep pools or on pool margins, deposited in small patches associated with boulder and bedrock obstructions, or deposited in the interstices of coarse bed materials. However, there is insufficient material and too high shear stress for substantive aggradation at least in the steeper reaches (e.g., greater than 2%) of the Middle Yuba, such as exist below Our House. Results of water quality sampling during 2012 found that turbidity in the Middle Yuba River was low. Overall, for this EFH indicator (i.e., sediment/turbidity), the Middle Yuba River is considered to be "properly functioning" under the baseline because sediment and turbidity are low.

YCWA may need to remove material from Our House Diversion Dam impoundment or Log Cabin Diversion Dam impoundment, or both. Historically, large storms, which have occurred approximately once every 10 to 20 years, have resulted in very large amounts of material accumulating in the impoundments in short periods (e.g., during a single storm period). Condition GS2 provides an excavation plan that addresses how material would be removed from the impoundments, where the material would be placed, how the material would be transported from the impoundment to its storage location, and measures YCWA would undertake to mitigate any adverse environmental effects.

YCWA proposed to pass sediment downstream of the Our House and Log Cabin diversion dams by opening the low level (5-foot diameter) outlet valves in the dams (GS3). Opening of a low level outlet in a diversion dam is an effective measure to pass sediment, which would otherwise accumulate behind the dam, to the river downstream of the dam. This continuous supply of sediment aids in the proper ecological function of the river. Condition GS3 provides that each year, at the appropriate time and when hydraulic conditions are favorable, YCWA will open the low level valves in Our House Diversion Dam and Log Cabin Diversion Dam. Specifically, the strategy is to open the valves for brief periods in the winter when the majority of the water would pass through the outlet – not over the dam – to maximize direction of flow and movement of sediment in the impoundment, and when a high flow is expected to occur soon after, to continue moving sediment downstream of the dam after the pass-through event. The purposes of restricting the event to the winter months is to allow the high spring flows, which are often high enough to continue to mobilize and redistribute moderate size sediment below the dam. Based on historic hydrology, YCWA expects that this measure would be implemented on average every other year at Our House Diversion Dam and once every 3 to 4 years at Log Cabin Diversion Dam.

Condition GS3 is expected to be beneficial to stream fish and EFH. Resident fish populations in project reaches were generally considered healthy and persistent with age class distributions indicative of natural reproduction. However, several studies suggest that availability of suitably sized spawning gravels is limited. Passage of sediments will likely improve habitat by increasing the amount of substrate available for rainbow trout spawning, as well as for this indicator of EFH.

Chemical Contamination/ Nutrients

YCWA's study data for the Middle Yuba River were consistent with the historic studies. Within and between seasons, water is of a high quality (Table 7.4.1-4). YCWA also found that most analytes were reported at non-detectable to just above reporting limit concentrations. The water is generally clear (i.e., average turbidity of <36 NTU), and near saturation with DO. Alkalinity is low (<100 mg/L in all samples) and pH is near neutral.

Based on data collected before 2009, the SWRCB identified the Middle Yuba River from Bear Creek to the North Yuba River as CWA (§) 303(d) State Impaired for mercury, which was based on fish tissue concentrations, rather than on surface water concentrations to support the listing (SWRCB 2010). YCWA's Bioaccumulation Study results were consistent with the previous findings and the SWRCB's listing rationale. The presence of methylmercury in surface water suggests that it may be bioaccumulating, as methylmercury is thought to be mercury's most bioavailable form. For this reason, this EFH indicator (i.e., chemical contamination/nutrients) for the Middle Yuba River is considered to be "at risk" under the baseline. Relative to existing aquatic habitat conditions, there would be no change to this EFH indicator as a result of the Proposed Action.

7.4.1.2.4 Channel Condition and Dynamics

Width/Depth Ratio

NMFS (1996) considered a properly functioning width/depth ratio to be less than 10, at risk to be 10 to 12, and not properly functioning to be greater than 12. The average width/depth ratio for the ground-mapped reaches in the Middle Yuba River – Oregon Creek and Our House Diversion Dam Reaches was 24. Therefore, this EFH indicator (i.e., width/depth ratio) would be considered to be "not properly functioning" under the existing conditions according to NMFS (1996).

As part of the Proposed Action, YCWA proposes to increase minimum flow releases from Our House Diversion Dam into the Middle Yuba River from 21-50 cfs to 21-80 cfs, depending on water year type. As described in Section 3.3.01, the Middle Yuba River has a coarse and resistant bed and banks along most of its length, with few possibilities of lateral or vertical shifting. There is significant bedrock control and the mainstem channel often travels through bedrock gorges. Although no quantitative studies have been conducted to specifically evaluate Proposed Action effects on width/depth ratio in the Middle Yuba River, given the relatively constrained nature of the channel, it is reasonable to assume that increased flows of up to 80 cfs during certain years under the Proposed Action could result in a slight improvement to this EFH indicator (i.e., width/depth ratio).

Table 7.4.1-4. Summary of Middle Yuba River water quality data (see Technical Memorandum 2-3 for complete results).

Analyte	Benchmark		Middle Yuba River		Middle Yuba River	
		Sample Location	Below Our House Dam Diversion		MYR at Yellowjacket upstream of confluence with NYR	
		Date	8/28/2012		8/29/2012	
		Units	Result	Notes	Result	Notes
latitude/longitude			642382	4364331	661426	4360648
In Situ Measurments						
Stream Flow[b]	--	cfs	--		--	
Temperature	--	°C	19.3		18.5	
Specific Conductance	900	µSiemans/cm	161		160	
pH	6.5-8.5	stnd units	7.5		7.7	
Dissolved Oxygen	< 7 mg/L	mg/L	8.6		8.1	
Turbidity	--	NTU	0.2		1.8	
Basic Water Quality						
Alkalinity, Total (as CaCO	20	mg/L	76		62	
Ammonia (as N)	Temp & pH Dep't	mg/L	0.1	ND	0.1	ND
Hardness, Total	--	mg/L	71		69	
Nitrate (as N)	10	mg/L	0.1	ND	0.1	ND
Nitrite (as N)	1	mg/L	0.1	ND	0.1	ND
o-Phosphate (as P)	--	mg/L	0.1	ND	0.1	ND
Phosphorus, Total	--	mg/L	0.026	J	0.06	J
Solids, Total Dissolved	500	mg/L	90		90	
Solids, Total Suspended	--	mg/L	1.1		1	ND
Total Kjeldahl Nitrogen	--	mg/L	0.5	ND	0.5	ND
Total Metals Concentrations						
Arsenic	10	µg/L	5.71		4.35	
Cadmium	5	µg/L	0.007	J	0.02	ND
Copper	1000	µg/L	0.33		0.40	
Lead	15	µg/L	0.004	J	0.04	ND
Mercury	50	ng/L	0.73		0.65	
Methyl Mercury	--	ng/L	0.100		0.054	
Dissolved Metals Concentrations						
Arsenic	--	µg/L	5.45		4.31	
Cadmium	Hardness Dep't	µg/L	0.005	J	0.02	ND
Copper	Hardness Dep't	µg/L	0.37		0.46	
Lead	Hardness Dep't	µg/L	0.04	ND	0.04	ND
Methyl Mercury	--	ng/L	0.069		0.042	J
NOTES						
B - Analyte was prsent in the associated method blank; J - Analyte was detected at a concentration below the reporting limit and above the laboratory method detection limit. Reported value is estimated; ND - Analyte included in the analysis, but not detected at the reporting limit.						

Streambank Conditions

Ground-mapped data for the 2.94 miles of the Middle Yuba River did not identify any bank erosion as a percentage of the reach. Because of the amount of bedrock and boulder control, channel stability is good and bank erosion hazard is low to very low. Therefore, it is assumed that the banks in this reach are stable, and it is properly functioning.

Under the Proposed Action, effects on channel stability would not be expected because most of the reaches are transport-dominated (i.e., few response reaches), and channels are resistant to further change. Relative to existing conditions in the Middle Yuba River, the Proposed Action would not be expected to substantively change this EFH indicator.

7.4.1.2.5 Habitat Elements

Substrate

As described in TM 3-8, habitat in a 349-feet long site in the Middle Yuba River downstream of Yellowjacket Creek was sampled, and cobble and gravel were found to be the dominant and sub-dominate substrates, respectively. The site was absent of suitable sized spawning gravel for resident trout. Average pool tail-out embeddedness (%) for the Middle Yuba River – Oregon Creek and Our House Diversion Dam Reaches was reported to be 12.6 percent. Cobble embeddedness also was estimated to the nearest 5 percent in Study 3-1 by visually inspecting the cobble to determine the percent that was buried by fine particles. In the Middle Yuba River sub-basin, the average percentage of cobble embeddedness was reported to be 35 percent below the Oregon Creek confluence, and 37 percent above the North Yuba River confluence (see TM 3-1). Therefore, overall, this EFH indicator (i.e., substrate) would be considered to be “at risk/not properly functioning” under the existing aquatic habitat conditions according to NMFS (1996) criteria.

Condition GS3 is expected to be beneficial to stream fish and EFH. Several studies suggest that availability of suitably sized spawning gravels for resident fish is limited. Passage of sediments will likely improve habitat by increasing the amount of substrate available for rainbow trout spawning. Relative to existing aquatic habitat conditions, minimal changes to this EFH indicator would be expected as a result of the Proposed Action.

Large Woody Material

YCWA’s Study 3.8 included sampling of fish populations in the Middle Yuba River. During these surveys, 8 pieces of LWM were observed in 2012, and 4 pieces of LWM were documented in 2013. Presently, wood passes through Project diversion tunnels associated with the Log Cabin and Our House Diversion Dams and the amount of wood cannot be estimated (see TM 6-1). In consideration of the survey results and the diversion dam operations upstream, this EFH indicator (i.e., LWM) would be considered to be “at risk” under the existing aquatic habitat conditions according to NMFS (1996) criteria.

As part of the Proposed Action, YCWA proposes to allow mobile instream LWM to continue downstream beyond Our House and Log Cabin diversion dams. All sizes of LWM greater than 8 inches in diameter and up to 36 feet in length will be allowed to continue downstream beyond the dams. However, the potential effects of the Proposed Action on LWM are not quantifiable because it is unclear how much LWM passes over the Log Cabin and Our House Diversion

Dams rather than passing through the associated diversion tunnels to the New Bullards Bar Reservoir. LWM passing over the diversion dams would be available to downstream reaches, but is unlikely to interact with streamflow. Field observations and literature indicate that the LWM in high gradient reaches becomes suspended on boulders above or outside of the streamflow, and is easily flushed downstream at high flow (Ruediger and Ward 1991). Over the long-term however, it is reasonable to assume that allowing LWM to pass downstream of Our House Diversion Dam and Log Cabin Diversion Dam would improve habitat conditions, as well as EFH.

7.4.1.2.6 Watershed Conditions (Riparian Reserves)

In the Middle Yuba River downstream of Oregon Creek, there was no visible change in riparian vegetation from earliest available photos (i.e., 1937 or 1939, depending on site) to 2009. In the Middle Yuba River downstream of Our House Diversion Dam, riparian vegetation increased over the period between the earliest available photo (i.e., 1937 and 1939) to 2009. The Oregon Creek Celestial Valley sub-reach assessment site showed a visible change in floodplain vegetation, but no obvious change to riparian vegetation. The Middle Yuba River upstream of Oregon Creek assessment site showed localized increases and decreases over time, with an overall increase in riparian vegetation from the earliest available photo (i.e., 1937) to 2009.

During field surveys conducted in 2011 and 2012, Middle Yuba River bankfull widths downstream of Oregon Creek ranged from 45 feet (transect 12) and 70 feet (transect 13). Floodprone widths ranged from 12 feet (transect 12) and 135 feet (transect 13). The Middle Yuba River above Oregon Creek Confluence sampling site (7.5 miles downstream of Our House Diversion Dam on the Middle Yuba River) reportedly provides about 30 percent canopy (see TM 3-1). The Middle Yuba River below Oregon Creek Confluence ground-based sampling site (approximately 0.2 miles downstream of the Oregon Creek confluence on the Middle Yuba River) reportedly provides 15 percent canopy cover (see TM 3-1). Canopy cover in the Middle Yuba River above North Yuba River confluence was not reported. Overall, YCWA assessed the Middle Yuba River sites as healthy because there is no indication of a lack of riparian function in these areas. One exception was the Oregon Creek Celestial Valley assessment site, which has the potential to become less healthy in the future. In this area, banks and floodplains were dominated by Himalayan blackberry under mid- and over-stories of shrubs and trees; various ages of riparian trees and shrubs were present, but few young recruits and seedlings were observed.

Two proposed aquatic resource conditions have the potential to have a beneficial effect on riparian vegetation. Condition AR1, Maintain Minimum Streamflows Below Our House Diversion Dam, Log Cabin Diversion Dam, and New Bullards Bar Dam, provides stabilized flows at levels similar to or higher than current flows on the Our House Diversion Dam Reach and the Log Cabin Diversion Dam Reach, providing conditions for riparian growth along the streamside. Condition AR2 - Control Project Spills at Our House Diversion Dam, may enhance riparian germination. The recession limb is designed to more closely follow the recession limb of a natural snow-melt hydrograph (depending on the water year type) during the growing season, which is intended to synchronize with the dispersal of native riparian species, providing more opportunity for successful germination and establishment.

Over the long-term, the proposed increased monthly releases under the Proposed Action would be expected to augment the existing hydrologic regime, which would maintain, or could provide a slight benefit to the existing adjacent riparian communities and this EFH indicator along the Middle Yuba River.

7.4.1.2.7 Prey Availability

The Middle Yuba River was sampled for BMI in three locations (RM 7.5, 8.2 and 12.5) downstream of Our House Diversion Dam. At the site upstream of Oregon Creek and the site downstream of Oregon Creek, low abundance limited the collection of organisms to 486 and 476 individuals per grid, respectively. These counts are just under the standard 500 organisms per grid used for IBI and MMI scoring and therefore the reliability of the calculated indices scores are considered low. IBI scores were 64, 69, and 59 from upstream to downstream, respectively. MMI scores were 62, 64, and 52 from upstream to downstream, respectively. All MMI scores were rated as 'fair' and approached a rating of 'good' which is greater than 67.

Under the Proposed Action, proposed conditions that may be beneficial to mollusks and BMI include the minimum streamflow measures (AR1), and implementation of an Aquatic Invasive Species Management Plan under Condition AR5. Over the long-term, the proposed flow changes under the Proposed Action would be expected to augment the existing hydrologic regime, which would maintain, or could potentially provide a benefit to the existing macroinvertebrate communities in the Middle Yuba River.

7.4.1.3 Yuba River Upstream of Englebright Reservoir

7.4.1.3.1 Habitat Access (Physical Barriers)

Under existing conditions, no potential passage barriers/impediments to resident trout were identified in the Yuba River Upstream of Englebright Reservoir. More importantly however, the Corps' 260-foot-high Englebright Dam currently blocks Chinook salmon access to all available EFH in the Yuba River upstream of the Englebright Reservoir. Consequently, for this indicator (i.e., habitat access), the EFH in the Yuba River is considered to be "not properly functioning" under existing habitat conditions due to the presence of the Corps' Englebright Dam. Because the Proposed Action would not change fish passage conditions at Englebright Dam, there would be no change to the current lack of access to EFH in the Yuba River upstream of Englebright Reservoir as a result of the Proposed Action.

7.4.1.3.2 Flow/Hydrology

Total river flow in the New Colgate Powerhouse Reach results from a combination of releases from New Colgate Powerhouse, New Bullards Bar Dam on the North Yuba River, Log Cabin Diversion Dam on Oregon Creek, and Our House Diversion Dam on the Middle Yuba River in combination with watershed accretions. To evaluate the combination of Project releases that contribute to increased base flows and the Proposed Action releases from New Colgate Powerhouse, YCWA calculated the amount of trout habitat that would be achieved under the Proposed Action, relative to the No Action Alternative scenario (existing conditions).

For hydrologic context, mean monthly flows in the North Yuba River upstream of the North Yuba/Middle Yuba rivers were simulated to compare conditions under the No Action Alternative (existing conditions) and the Proposed Project (Proposed Action) (Table 7.4.1-5).

Table 7.4.1-5. Mean monthly flows (cfs) in the North Yuba/Middle Yuba River Reach for the Yuba River Index water year types from Water Year 1970 through Water Year 2010.

Month	Average Monthly Discharge (cfs)		
	YR Node 1		
	No Action Alternative	Proposed Project	Change (% Change)
October	52	65	14 (26.3%)
November	129	148	19 (15.1%)
December	527	591	63 (12.0%)
January	1,101	1,088	-13 (-1.2%)
February	806	823	17 (2.1%)
March	919	945	26 (2.9%)
April	482	510	28 (5.8%)
May	607	657	50 (8.2%)
June	337	387	50 (14.9%)
July	62	96	34 (55.6%)
August	49	63	15 (30.6%)
September	47	57	10 (22.3%)

To evaluate the potential effects of Proposed Project releases on base flows in the Yuba River downstream of New Colgate Powerhouse, mean monthly flows and average monthly releases from New Colgate Powerhouse under the Proposed Action also were simulated (Table 7.4.1-6).

Table 7.4.1-6. Mean monthly flows (cfs) downstream of the New Colgate Powerhouse for the Yuba River Index water year types from Water Year 1970 through Water Year 2010.

Month	Average Monthly Discharge (cfs)								
	Inflow (Upstream of New Colgate PH)			CPH Node 0			CPH Node 1		
	No Action Alternative	Proposed Project	Change (% Change)	No Action Alternative	Proposed Project	Change (% Change)	No Action Alternative	Proposed Project	Change (% Change)
October	53	66	13 (24.5%)	778	786	9 (1.1%)	779	787	9 (1.1%)
November	135	155	20 (14.8%)	925	945	21 (2.2%)	930	950	21 (2.2%)
December	545	608	63 (11.6%)	1,519	1,567	49 (3.2%)	1,533	1,582	49 (3.2%)
January	1,131	1,119	-12 (-1.1%)	2,594	2,569	-25 (-1.0%)	2,620	2,596	-25 (-0.9%)
February	836	856	20 (2.4%)	2,644	2,627	-18 (-0.7%)	2,673	2,655	-18 (-0.7%)
March	954	980	26 (2.7%)	2,739	2,740	1 (0.0%)	2,769	2,771	1 (0.0%)
April	506	534	28 (5.5%)	2,037	2,032	-5 (-0.3%)	2,058	2,052	-5 (-0.3%)
May	622	671	49 (7.9%)	2,825	2,810	-16 (-0.6%)	2,838	2,822	-16 (-0.6%)
June	341	391	50 (14.7%)	2,598	2,575	-22 (-0.9%)	2,601	2,579	-22 (-0.9%)
July	63	97	34 (54.0%)	1,995	1,988	-7 (-0.4%)	1,996	1,989	-7 (-0.4%)
August	49	64	15 (30.6%)	1,571	1,569	-1 (-0.1%)	1,571	1,570	-1 (-0.1%)
September	47	58	11 (23.4%)	817	829	13 (1.6%)	817	830	13 (1.6%)

YCWA calculated the amount of rainbow trout habitat that would be achieved under the Proposed Action, relative to the No Action Alternative. In the 5.7-mile long Yuba River reach from the confluence of the Middle and North Yuba rivers to just above New Colgate Powerhouse, the combined effect of releases at Project facilities (New Bullard Bar Dam, Our House Diversion Dam, Log Cabin Diversion Dam) upstream of this reach under the Proposed Action resulted in an increase in habitat for adult rainbow trout during all months except March through May when average monthly flows exceeded the discharge values associated with optimal WUA. In general, there was little change in rainbow trout spawning habitat. While increases to the adult lifestage habitat were observed, juvenile rainbow trout shows slight reductions in habitat year round, relative to the No Action Alternative (existing conditions). Habitat duration results (see Section 3.3.03 of the DLA) demonstrate that effects of the Proposed Action may have a positive effect on habitat for the adult lifestage of rainbow trout. Minor reductions in juvenile rainbow trout were identified under the Proposed Action, relative to the No Action Alternative (existing conditions).

As shown by the habitat summary tables and figures presented in Section 3.3.03 of the DLA, in most instances, the Proposed Action provides the same or better habitat than would otherwise be provided for rainbow trout adult and spawning lifestages under the No Action Alternative (existing conditions). Flow-related benefits (e.g., increased habitat availability, cooler water temperatures) to resident trout associated with increased monthly releases under the Proposed Action also would be expected to improve flow-related conditions for EFH in the Yuba River Upstream of Englebright Reservoir.

7.4.1.3.3 Water Quality

Thermal Refugia (Water Temperature)

As previously described, Yuba River water temperature monitoring results from 2009 through 2012 show that maximum daily average water temperatures below Project facilities in the Yuba River upstream of Englebright Reservoir were less than the upper tolerance WTI of 68°F (20°C) for Chinook salmon adult immigration and staging except for: 1) about 66 percent of days from June through September near the confluence of the North Yuba and Middle Yuba rivers; and 2) 67 percent of the days from June through October upstream of New Colgate Powerhouse. Maximum daily average water temperatures in the Yuba River downstream of New Colgate Powerhouse and downstream of Dobbins Creek did not exceed the 65F° upper tolerance WTI for Chinook salmon juvenile rearing during the 2009 through 2012 monitoring period. Consequently, available data suggest that, for this EFH indicator (i.e., thermal refugia), the Yuba River Upstream of Englebright Reservoir could be considered to be "at risk" under the baseline.

In the reach downstream of the Middle Yuba and North Yuba confluence, the Proposed Action would not adversely affect fish due to increases in water temperature. Increased minimum flows are not expected to reduce Middle Yuba River water temperatures below 20.0°C (68°F) because historical inflow to Our House and Log Cabin Diversion Dams are above 20.0°C (Table 7.4.1-7). Increased minimum flows downstream of New Bullards Bar Dam result in simulated average daily water temperatures are the same or colder under the Proposed Project Alternative (Proposed Action) than under the No Action Alternative (existing conditions). Combined, these releases result in a small reduction of summer water temperatures.

Table 7.4.1-7. Comparison of Simulated Mean Monthly Water in the Yuba River downstream of the Middle Yuba and North Yuba River confluence, for the No Action Alternative (existing conditions) and Proposed Project Alternative (Proposed Action), for Water Years 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change[1]		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
January	1.3	4.4	9.7	1.8	4.5	6.7	-0.6	-0.2	2.9
February	1.2	6.2	9.4	1.6	6.2	7.0	-0.3	0.0	2.4
March	5.6	8.9	13.3	5.6	8.6	8.7	0.0	0.3	4.7
April	6.0	11.9	17.6	5.8	11.5	11.7	0.2	0.4	5.8
May	7.8	15.3	23.7	7.6	14.8	16.5	0.1	0.4	7.2
June	8.3	19.9	26.5	7.8	19.5	21.9	0.5	0.5	4.7
July	9.4	24.7	28.0	9.5	23.3	28.1	-0.1	1.4	-0.1
August	18.9	23.1	26.9	17.8	21.5	27.5	1.1	1.5	-0.6
September	14.7	19.4	23.7	13.9	18.2	24.6	0.8	1.3	-0.9
October	6.9	13.7	22.9	6.9	13.0	17.4	0.0	0.7	5.5
November	3.0	7.5	12.3	3.2	7.5	10.6	-0.3	0.0	1.7
December	0.5	4.4	10.8	0.9	4.6	7.2	-0.4	-0.2	3.7

[1] A positive value indicates cooler water temperatures under the Proposed Action.

The change in mean monthly water temperatures downstream of New Colgate Powerhouse shows little to no difference (Table 7.4.1-8), suggesting that there would be no adverse effect to habitat conditions in this short reach.

Overall, as shown above and more fully described in Section 3.3.03 of the DLA, the Proposed Action would not adversely affect resident fish habitat due to increases in Yuba River water temperatures upstream of Englebright Reservoir. Similarly, compared to existing conditions, the Proposed Action would not be expected to adversely affect EFH (i.e., thermal refugia) in the Yuba River upstream of Englebright Reservoir. There are two thermal refugia present in the Action Area of the Yuba River upstream of Englebright Reservoir, in the Yuba River below the New Colgate Powerhouse, and in the North Yuba River immediately below the New Bullards Bar Reservoir. These refugia are expected to improve, or remain the same, under the Proposed Action, compared to existing conditions.

Table 7.4.1-8. Comparison of Simulated Mean Monthly Water Temperatures in the Yuba River downstream of the New Colgate Powerhouse (New Colgate Powerhouse Reach), for the No Action Alternative and Proposed Project Alternative, for Water Years 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change[1]		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
January	1.2	7.1	10.2	1.4	7.0	6.7	-0.2	0.1	3.4
February	3.3	7.0	9.7	3.4	7.0	7.0	-0.1	0.0	2.7
March	6.0	7.7	13.4	6.1	7.7	8.7	0.0	0.0	4.7
April	6.2	8.2	15.0	6.2	8.3	11.7	0.0	-0.1	3.3
May	6.9	8.3	17.2	7.0	8.4	16.5	-0.1	-0.1	0.7
June	7.1	8.5	12.4	7.4	8.7	21.9	-0.2	-0.2	-9.4
July	7.4	8.8	10.9	7.7	9.0	28.1	-0.3	-0.2	-17.2
August	7.9	9.2	11.8	7.9	9.3	27.5	0.0	-0.1	-15.7
September	8.5	9.8	14.8	8.5	9.8	24.6	0.0	-0.1	-9.8
October	8.7	9.8	12.9	8.7	9.9	17.4	0.0	-0.1	-4.5
November	2.9	9.5	12.9	3.1	9.4	10.6	-0.3	0.1	2.3
December	0.5	7.9	11.4	0.7	7.8	7.2	-0.2	0.2	4.3

[1] A positive value indicates cooler water temperatures under the Proposed Action.

Sediment/Turbidity

The large size of the substrate in the bed and banks of the Yuba River below the North/Middle Yuba River confluence and lack of deformable substrate are such that sediment transport is likely minor. Overall, for this EFH indicator (i.e., sediment/turbidity), the Yuba River would be considered to be "properly functioning" under the baseline because sediment and turbidity are low. The Proposed Action is not anticipated to substantively change this EFH indicator.

Chemical Contamination/Nutrients

For the Yuba River upstream of Englebright Reservoir, water is of a high quality (Table 7.4.1-9). YCWA also found that most analytes were reported to be at non-detectable levels to just above reporting limit concentrations. The water is generally clear (i.e., average turbidity of <36 NTU), and near saturation with DO. Alkalinity is low (<100 mg/L in all samples) and pH is near neutral.

Based on data collected before 2009, the SWRCB identified the Yuba River Upstream of Englebright Reservoir as CWA (§) 303(d) State Impaired for mercury, which was based on fish tissue concentrations, rather than on surface water concentrations to support the listing (SWRCB 2010). YCWA's bioaccumulation study results were consistent with the previous findings and the SWRCB's listing rationale. The presence of methylmercury in surface water suggests that it may be bioaccumulating, as methylmercury is thought to be mercury's most bioavailable form. For this reason, this EFH indicator (i.e., chemical contamination/nutrients) for the Yuba River upstream of Englebright Reservoir is considered to be "at risk" under existing conditions. Relative to existing conditions, there would not be substantive changes to this EFH indicator as a result of the Proposed Action.

7.4.1.3.4 Channel Condition and Dynamics

Width/Depth Ratio

The average width/depth ratio for the ground-mapped reaches in the Yuba River – New Colgate Powerhouse and Middle/North Yuba River Reaches was 16. Therefore, this EFH indicator (i.e., width/depth ratio) would be considered to be "not properly functioning" under existing conditions according to NMFS (1996) criteria.

As previously described, YCWA proposes to increase minimum flow releases from the North Yuba River by up to 13 cfs and the Middle Yuba River by up to 80 cfs, depending on water year type. As previously described, this 7.1 mile channel of the Yuba River is a confined, bedrock-dominated reach that passes through bedrock canyons with vertical walls that inhibit ground access. Although no quantitative studies have been conducted to specifically evaluate Proposed Action effects on width/depth ratio in the Yuba River Upstream of Englebright Reservoir, it is reasonable to assume that due to the planform geometry, it is unlikely that increased flows from the North Yuba and Middle Yuba rivers during certain years under the Proposed Action would substantially affect this EFH indicator (i.e., width/depth ratio).

7.4.1.3.5 Streambank Conditions

Ground-mapped data for the 1.86 miles of the Yuba River – New Colgate Powerhouse and Middle/North Yuba River Reaches did not identify any bank erosion as a percentage of the reach. The banks downstream of New Colgate Powerhouse are generally stable, comprised mostly of bedrock and boulder, with only a minor amount of bank erosion. Therefore, it is assumed that the banks in this reach are stable, and it is properly functioning.

Under the Proposed Action, effects on channel stability would not be expected because the reaches are generally transport-dominated, and channels are resistant to further change. As previously discussed, YCWA does not propose any changes to the Project or its operations that would have a significant effect on overall channel stability or the nature of the transport reaches. YCWA's proposed Conditions GS2 and GS3 would reduce the storage and character of the sediments impounded in the diversion pools and would result in an increase in mobile sediment downstream of Our House and Log Cabin diversion dams, which could potentially increase sediment in the Yuba River. The added sediment could create localized deposits, which the channel could then adjust to by possibly moving into, through, and around the deposits. These site-specific channel-shifts in response to added sediment supply would be considered beneficial. Relative to existing conditions in the Yuba River upstream of Englebright Reservoir, the Proposed Action would not be expected to substantively change this EFH indicator.

Table 7.4.1-9. Summary of Yuba River Upstream of Englebright Dam water quality data (see Technical Memorandum 2-3 for complete results).

Analyte	Benchmark	*Sample Location*	Yuba River Above Colgate Powerhouse		Yuba River Below Colgate Powerhouse		Yuba River At Rice Crossing[a]	
		Date	8/29/2012		8/29/2012		8/28/2012	
		Units	Result	Notes	Result	Notes	Result	Notes
latitude/longitude			656003	4355032	655742	4354997	654768	4352982
In Situ Measurments								
Stream Flow[b]	--	cfs	--		--		--	
Temperature	--	°C	20.3		8.7		9.7	
Specific Conductance	900	µSiemans/cm	158		71		73	
pH	6.5-8.5	stnd units	7.5		7.7		7.8	
Dissolved Oxygen	< 7 mg/L	mg/L	8.2		10.3		12.1	
Turbidity	--	NTU	1.7		7		14.1	
Basic Water Quality								
Alkalinity, Total (as CaCO	20	mg/L	62		24		32	
Ammonia (as N)	Temp & pH Dep't	mg/L	0.1	ND	0.1	ND	0.1	ND
Hardness, Total	--	mg/L	65		29		31	
Nitrate (as N)	10	mg/L	0.1	ND	0.1	ND	0.1	ND
Nitrite (as N)	1	mg/L	0.1	ND	0.1	ND	0.1	ND
o-Phosphate (as P)	--	mg/L	0.1	ND	0.1	ND	0.039	J
Phosphorus, Total	--	mg/L	0.094	J	0.08	J	0.045	J
Solids, Total Dissolved	500	mg/L	87		43		47	
Solids, Total Suspended	--	mg/L	1	ND	1	ND	1	ND
Total Kjeldahl Nitrogen	--	mg/L	0.5	ND	0.5	ND	0.5	ND
Total Metals Concentrations								
Arsenic	10	µg/L	4.01		0.47		0.65	
Cadmium	5	µg/L	0.009	J	0.02	ND	0.009	J
Copper	1000	µg/L	0.35		0.39		0.66	
Lead	15	µg/L	0.04	ND	0.006	J	0.030	J
Mercury	50	ng/L	0.65		0.53		0.64	
Methyl Mercury	--	ng/L	0.081		0.05	ND	0.05	ND
Dissolved Metals Concentrations								
Arsenic	--	µg/L	3.93		0.43		0.56	
Cadmium	Hardness Dep't	µg/L	0.011	J	0.02	ND	0.006	J
Copper	Hardness Dep't	µg/L	0.42		0.36		0.35	
Lead	Hardness Dep't	µg/L	0.04	ND	0.04	ND	0.003	J
Methyl Mercury	--	ng/L	0.032	J	0.05	ND	0.05	ND

NOTES

* At Rice Crossing, Downstream of Dobbins Creek, upstream of Englebright Dam.

the laboratory method detection limit. Reported value is estimated; ND - Analyte included in the analysis, but not detected at the reporting limit.

7.4.1.3.6 Habitat Elements

Substrate

As described in TM 3-8, habitat in a 359-feet long site in the Yuba River upstream of the Middle Yuba River was sampled, and bedrock and cobble were the dominant and sub-dominate substrates, respectively. Approximately 10 square feet of resident trout sized spawning gravel was identified in the site. Habitat in a 702-feet long site in the Yuba River downstream of the New Colgate Powerhouse was found to have boulder and cobble as the dominant and sub-dominant substrates, respectively. Approximately 83 square feet of resident trout sized spawning gravel was identified in the site. Additionally, habitat in a 411-feet long site in the Yuba River downstream of the Middle Yuba River was sampled, and cobble and boulder were the dominant and sub-dominate substrates, respectively. This site was absent of suitable sized spawning gravel for resident trout.

Cobble embeddedness also was estimated to the nearest 5 percent in Study 3-1 by visually inspecting the cobble to determine the percent that was buried by fine particles. In the Yuba River above Colgate Powerhouse, the average percentage of cobble embeddedness was reported to be 18 percent. In the Yuba River below Colgate Powerhouse, the average percentage of cobble embeddedness was reported to be 26 percent. Therefore, overall, this EFH indicator (i.e., substrate) would be considered to be “at risk/not properly functioning” under existing conditions. Relative to existing conditions, minimal changes to this EFH indicator would be expected as a result of the Proposed Action.

Large Woody Material

YCWA’s Study 3.8 included sampling of fish populations at one site on the Yuba River (RM 33.7) between New Colgate Powerhouse and Englebright Reservoir. No LWM was documented during 2012 or 2013. In consideration of these survey results and the operational practices upstream that do not allow for the mobilization of LWM downstream of New Bullards Bar Dam on the North Yuba River, this EFH indicator (i.e., LWM) would be considered to be “at risk” under existing conditions. Over the long-term, it is reasonable to assume that allowing LWM to pass through Our House Diversion Dam and Log Cabin Diversion Dam could make it available to downstream reaches in the Yuba River upstream of Englebright Reservoir, which could improve habitat conditions, as well as this indicator of EFH.

7.4.1.3.7 Watershed Conditions (Riparian Reserves)

In the Yuba River upstream of New Colgate Powerhouse, there was no visible change in riparian vegetation from earliest available photos (i.e., 1937 or 1939, depending on site) to 2009. In the Yuba River downstream of the New Colgate Powerhouse riparian assessment site, riparian vegetation increased over the period between the earliest available photo (i.e., 1937 and 1939) to 2009.

During field surveys conducted in 2011 and 2012, bankfull widths ranged from 200 feet (transect 1), 130 feet (transect 2) and 120 feet (transect 3). Floodprone widths ranged from 335 feet (transect 1), 600 feet (transect 2) and 320 feet (transect 3). Moderate canopy was present (20%) in the Yuba River above Colgate Powerhouse sampling site (approximately 0.6 mi upstream of New Colgate Powerhouse). The Yuba River below Colgate Powerhouse sampling site (approximately 0.6 mi downstream of New Colgate Powerhouse) also was reported to have a relatively moderate canopy (22%). According to NMFS (1996), “properly functioning” riparian habitat provides adequate shade, LWM recruitment, habitat protection and connectivity, and buffers or refugia for sensitive aquatic species (>80% intact). In consideration of the above, this EFH indicator (i.e., riparian reserves) is assumed to be “at risk” under existing conditions due to past watershed disturbance and the moderate canopy observed during recent surveys, according to NMFS (1996) criteria.

As discussed in TM 6-1, in the Yuba River downstream of New Colgate Powerhouse, the Proposed Action would inundate bankfull widths most frequently from December to July, with low frequency or no inundation from September to November. Floodprone widths are infrequently inundated, with January having the highest percentage of days of inundation under With-Project Hydrology (existing conditions).

Over the long-term, the proposed increased monthly releases under the Proposed Action would be expected to augment the existing hydrologic regime, which would maintain, or could provide a slight benefit to the existing adjacent riparian communities and this EFH indicator along the Yuba River upstream of Englebright Reservoir.

7.4.1.3.8 Prey Availability

Samples of BMI were collected in two locations on the Yuba River - RM 7.6 and RM 8.8. The lower site is 0.56 RM below New Colgate Powerhouse and does not have an impoundment, but releases water from deep within the upstream impoundment. Sampling at the upstream location only provided 198 total organisms per grid, which is below the standard 500 organisms per grid used for IBI and MMI scoring and also represented the lowest number collected for all samples. Therefore, the reliability of the calculated indices scores are considered low. Nonetheless, IBI scores were 30 and 47 from upstream to downstream, respectively. MMI scores were 26 and 34 from upstream to downstream with subsequent ratings of ‘poor’ and ‘fair’ respectively.

Habitat in some locations was not conducive to high abundance of BMI. Lower scores in these locations appeared to be primarily driven by the existing habitat, and not by other external factors or conditions.

Hydrology within the Yuba River has reduced higher flow events and increased base flows during summer months. There is a subset of BMI that out-competes other common species during higher flow events and may be reduced in abundance as a result of fewer high flow events. Conversely, the stable base flows favor a higher species density, which also increases available feeding resources to local fish populations. While the Proposed Action may create a small incremental effect as a result of altered flood flows, the resulting benefit of baseflows offsets the potential issue.

Under the Proposed Action, proposed conditions that may be beneficial to mollusks and BMI include the minimum streamflow measures (AR1), and implementation of an Aquatic Invasive Species Management Plan under Condition AR5. Over the long-term, the proposed flow changes under the Proposed Action would be expected to augment the existing hydrologic regime, which would maintain, or could potentially provide a benefit to the existing macroinvertebrate communities in the Yuba River Upstream of Englebright Reservoir.

7.4.1.4 Summary of EFH in the Yuba River Watershed Upstream of Englebright Dam

Overall, the Proposed Action would not eliminate, diminish, or disrupt unoccupied EFH in the Yuba River watershed upstream of Englebright Reservoir. Although climate change was identified as a new threat during the 2011 5-Year review, effects on EFH that may result from climate change would not be attributable to the Proposed Action. In fact, the Proposed Action attempts to achieve moderate improvements in aquatic habitat conditions, while maintaining as much hydropower generation as possible, to offset fossil fueled electricity generation and support increased renewable generation sources. This will minimize the contribution of the Proposed Action to the effects of global warming, within the ability of the Proposed Action to affect this stressor. Nevertheless, it is recognized that climate change will continue to be a stressor to EFH for Chinook salmon. Of the other 21 threats to Pacific salmon EFH identified in Amendment 14 of the FMP, the Proposed Action could potentially affect EFH through changes in flows and water temperatures in the reaches of the Yuba River upstream of Englebright Reservoir that are downstream of Project facilities. However, flow and water temperature-related effects on EFH upstream of Englebright Reservoir associated with the Proposed Action are expected to result in non-substantive effects, or beneficial effects.

7.4.2 Yuba River Downstream of Englebright Dam

In the lower Yuba River, the component of the Proposed Action that has potential to affect EFH is associated with the maintenance of instream flows below Narrows 2 powerhouse. The Proposed Action includes continued implementation of the Yuba Accord flow schedules, with the one exception of a change in minimum flow requirements during conference years (Table 7.4.2-1). In addition to this component of the Proposed Action, changes in maintaining instream flow requirements below Project facilities in the Yuba River watershed upstream of Englebright Dam has the potential to influence the magnitude and pattern of inflow to Englebright Reservoir, and therefore in the lower Yuba River. The Proposed Action components are included in the Project operations model and water temperature model. Therefore, potential effects of all flow and water temperature-related components of the Proposed Action can be assessed by evaluation of hydrologic and water temperature simulation model output, as presented in the following sections.

7.4.2.1 Flow-Dependent Habitat Availability

7.4.2.1.1 Spring-run Chinook Salmon Spawning Habitat

Table 7.4.2-2 displays the long-term average and average by water year type spring-run Chinook salmon spawning WUA (percent of maximum) under the Proposed Action and Environmental Baseline scenarios. Over the entire 41-year simulation period, long-term average spring-run Chinook salmon spawning habitat availability (WUA) in the lower Yuba River is essentially equivalent under the Proposed Action relative to the Environmental Baseline (long-term average of 94.6 percent versus 94.5 percent of the maximum WUA). The Proposed Action provides the same average amount of spawning habitat during wet years, 0.2 percent less maximum spawning habitat during above normal water years, and 1.1 percent less during below normal water years.

The Proposed Action provides 0.1 percent more average amounts of maximum spawning habitat during dry water years and 1.2 percent more during critical water years. As with the Environmental Baseline, the Proposed Action scenario provides, on the average, over 90 percent of maximum spawning WUA during all water year types.

Table 7.4.2-1. Conference year flow requirements at Marysville.

Period	Days in period	Conference Year Flow Requirements at Marysville - cfs		Conference Year Flow Requirements at Marysville - AF	
		Proposed Action	Environmental Baseline	Proposed Action	Environmental Baseline
October 1 - 15	15	350	400	10,395.0	11,880.0
October 16 - 30	15	350	400	10,395.0	11,880.0
November 1 - 30	30	350	400	20,790.0	23,760.0
December 1 - 31	31	350	400	21,483.0	24,552.0
January 1- 15	15	350	245	10,395.0	7,276.5
January 16 – 31	16	350	245	11,088.0	7,761.6
February 1 - 29	29	350	245	20,097.0	14,067.9
March 1- 31	31	350	245	21,483.0	15,038.1
April 1 - 15	15	300	245	8,910.0	7,276.5
April 16 - 30	15	245	245	7,276.5	7,276.5
May 1 - 15	15	245	245	7,276.5	7,276.5
May 16 - 31	16	245	245	7,761.6	7,761.6
June 1 - 15	15	245	245	7,276.5	7,276.5
June 16 - 30	15	245	245	7,276.5	7,276.5
July 1 - 31	31	150	70	9,207.0	4,296.6
August 1 - 31	31	150	70	9,207.0	4,296.6
September 1 - 30	30	150	70	8,910.0	4,158.0

Table 7.4.2-2. Long-term and water year type average spring-run Chinook salmon spawning WUA (percent of maximum) under the Proposed Action and Environmental Baseline scenarios.

Scenario	Long-term Full Simulation Period[2]	Water Year Types[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Proposed Action	94.6	92.8	94.3	94.3	96.1	97.3
Environmental Baseline	94.5	92.8	94.5	95.4	96.0	96.1
Difference	0.1	0.0	-0.2	-1.1	0.1	1.2

1 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification.
2 Based on the WY 1970-2010 simulation period.

Habitat duration curves for spring-run Chinook salmon spawning under the Proposed Action and Environmental Baseline scenarios are presented in Figure 7.4.2-1. The Proposed Action provides slightly greater amounts of spawning habitat availability over about the lowest 20 percent of the exceedance probability distribution. Also, the Proposed Action achieves over 90 percent of maximum spawning WUA with about an 88 percent probability, similar to the Environmental Baseline scenario which achieves over 90 percent of maximum spawning WUA with about a 87 percent probability.

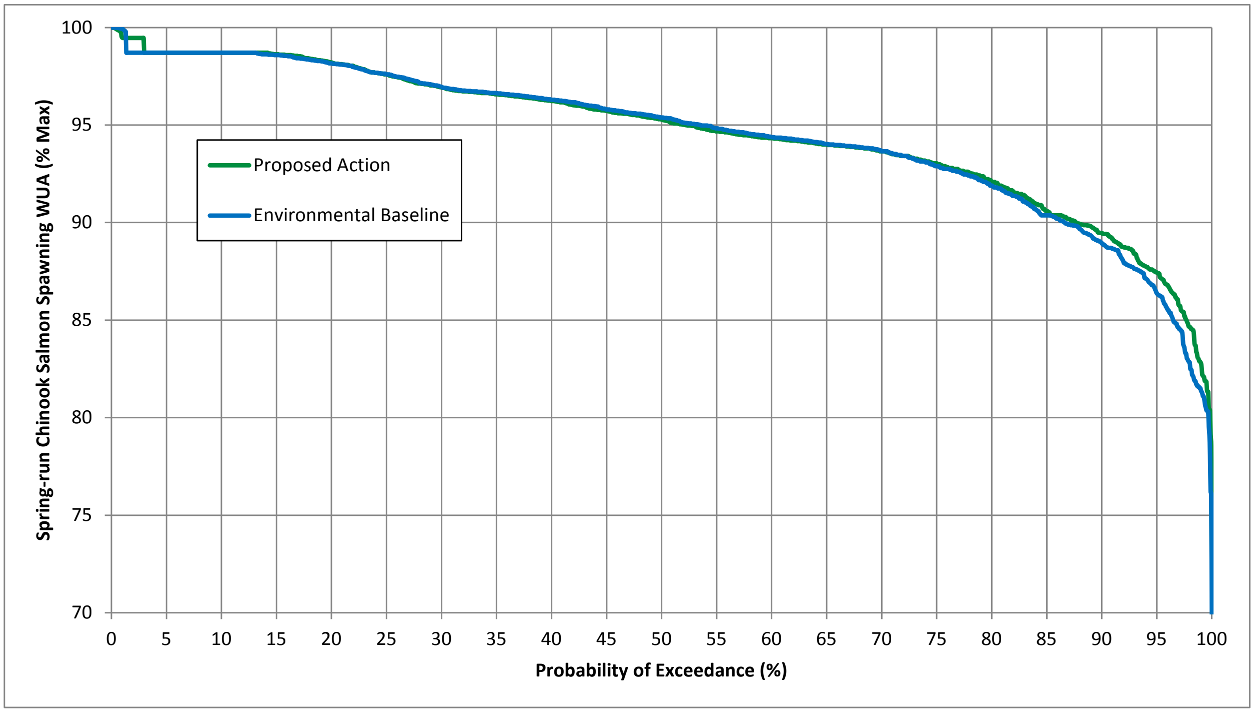

Figure 7.4.2-1. Spring-run Chinook salmon spawning habitat duration over the 41-year hydrologic period for the Proposed Action and Environmental Baseline scenarios.

During the one conference year (WY 1977) included in the simulated period of evaluation (WY 1970-2010), 98.2 percent of spring-run Chinook salmon maximum spawning WUA was provided under the Proposed Action compared to 98.2 percent provided under the Environmental Baseline scenario.

7.4.2.1.2 Fall-run Chinook Salmon Spawning Habitat

Table 7.4.2-3 displays the long-term average and average by water year type for fall-run Chinook salmon spawning WUA (percent of maximum) under the Proposed Action and Environmental Baseline scenarios. Over the entire 41-year simulation period, long-term average spring-run Chinook salmon spawning habitat availability (WUA) in the lower Yuba River is essentially equivalent under the Proposed Action relative to the Environmental Baseline (long-term average of 93.1 percent versus 93.3 percent of the maximum WUA). The Proposed Action provides the same average amount of spawning habitat during wet, below normal and critical water year types, 1.3 percent less maximum spawning habitat during above normal water years, and 0.3 percent less during dry water years.

Table 7.4.2-3. Long-term and water year type average fall-run Chinook salmon spawning WUA (percent of maximum) under the Proposed Action and Environmental Baseline scenarios.

Scenario	Long-term Full Simulation Period[2]	Water Year Types[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Proposed Action	93.1	89.3	93.3	93.4	95.9	97.0
Environmental Baseline	93.3	89.2	94.5	93.4	96.2	97.0
Difference	-0.2	0.0	-1.3	0.0	-0.3	0.0

[1] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

Habitat duration curves for fall-run Chinook salmon spawning under the Proposed Action and Environmental Baseline scenarios are presented in Figure 7.4.2-2. The Proposed Action provides similar amounts of spawning habitat availability over the entire exceedance probability distribution, with the exception of slightly less habitat over about 7 percent of the distribution. The Proposed Action achieves over 90 percent of maximum spawning WUA with about an 81 percent probability, similar to the Environmental Baseline scenario which achieves over 90 percent of maximum spawning WUA with about an 82 percent probability.

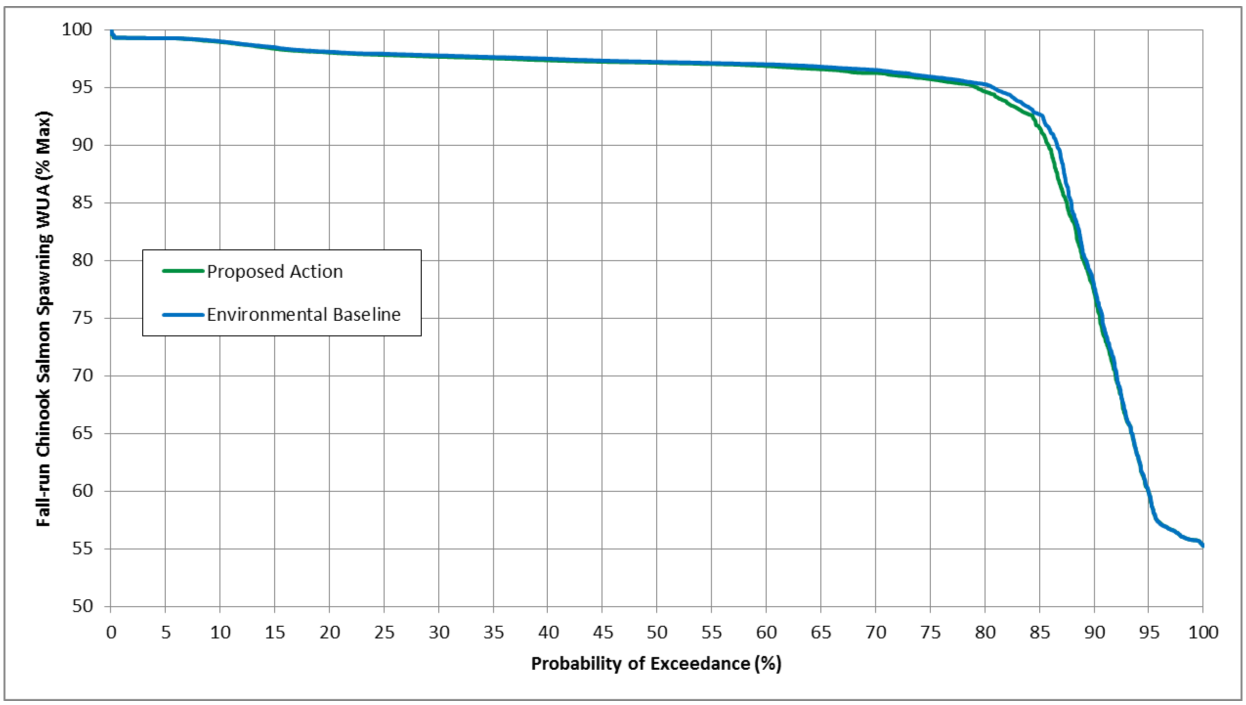

Figure 7.4.2-2. Fall-run Chinook salmon spawning habitat duration over the 41-year hydrologic period for the Proposed Action and Environmental Baseline scenarios.

During the one conference year (WY 1977) included in the simulated period of evaluation (WY 1970-2010), 97.5 percent of fall-run Chinook salmon maximum spawning WUA was provided under the Proposed Action compared to 97.5 percent provided under the Environmental Baseline scenario.

Flow-dependent spawning habitat availability under the Environmental Baseline represents a low stressor to Yuba River Chinook salmon. Because of the similarity in spawning habitat availability under the Proposed Action relative to the Environmental Baseline, this stressor remains characterized as low under the Proposed Action.

Moreover, the Proposed Action provides substantially more spring-run Chinook salmon and fall-run Chinook salmon spawning habitat than does the Without-Project scenario. As previously described, the Without-Project scenario achieves over 90 percent of spring-run and fall-run Chinook salmon maximum spawning WUA with only about a 60 percent and 44 percent probability, respectively.

7.4.2.2 Fry and Juvenile Stranding

Controlled flow fluctuations and ramping rates, intended to protect anadromous salmonids, including Chinook salmon, are specified in RD-1644. (RD-1644, pp. 178-179, term 3.) Project controlled flow reductions in the fall are completed by early September and river flows then are maintained at relatively stable levels through the fall to provide stable spawning flows for spring-run and fall-run Chinook salmon and to protect redds from dewatering. These Project operations also act to minimize stranding of Chinook salmon fry, which begin to emerge from redds in November. Thereafter, lower Yuba River flows during the winter and spring are often uncontrolled, and stranding of Chinook salmon fry and juveniles can occur naturally during periods of uncontrolled runoff and spills, either through uncontrolled flow fluctuations or as runoff subsides and flows drop to controllable levels. Under the Environmental Baseline, fry and juvenile stranding represents a stressor of low to medium magnitude to Chinook salmon. Because the Proposed Action will not affect the magnitude of this stressor, the potential “exposure” of Chinook salmon to this stressor, or the effects of this stressor on Chinook salmon EFH, it remains a low to medium stressor to Chinook salmon in the lower Yuba River.

7.4.2.3 Water Temperature

7.4.2.3.1 Proposed Action Scenario Water Temperatures

Spring-run Chinook Salmon

Adult Immigration
Over the April through September adult immigration lifestage period, the water temperature index value of 68°F is not exceeded with a 10 percent or greater probability at any of the three evaluated locations (Table 7.4.2-4).

Adult Holding
Over the April through September adult holding lifestage period, the water temperature index value of 65°F is not exceeded with a 10 percent or greater probability at Smartsville or Daguerre Point Dam, but is exceeded with a 10 percent or greater probability at Marysville from mid-June through mid-September. However, over the 2007-2013 monitoring period, water temperatures at Marysville never exceeded or even reached 65°F during any time of the year. Additionally, the RMT’s adult spring-run Chinook salmon acoustic tagging study found that adult spring-run

Chinook salmon do not spend extended periods of time at downstream locations (e.g., Marysville). Adult spring-run Chinook salmon were found to primarily exhibit holding behavior just downstream of or above Daguerre Point Dam during their adult holding period (RMT 2013).

Table 7.4.2-4. Proposed Action modeled water temperature exceedances[29] for spring-run Chinook salmon lifestage- and location-specific periodicities in the lower Yuba River at Smartsville (SMRT), below Daguerre Point Dam (DPD), and Marysville (MRY).

Spring-run Chinook Salmon Lifestage	Node	Upper Tolerance WTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration	SMRT	68°F							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
	Below DPD	68°F							0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.5	1.8	2.3	1.3	0.2						
	MRY	68°F							0.0	0.0	0.0	0.3	2.0	2.8	3.3	3.7	2.8	3.0	2.4	2.4						
Adult Holding	SMRT	65°F							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
	Below DPD	65°F							0.0	0.0	0.0	0.0	0.3	1.6	2.4	2.4	2.4	2.4	2.4	2.3						
	MRY	65°F							0.0	0.2	0.3	2.6	7.8	13.7	22.1	28.0	18.4	18.8	10.9	4.7						
Spawning	SMRT	58°F																	2.4	2.4	2.4					
Embryo Incubation	SMRT	58°F																	2.4	2.4	2.4	2.4	1.5	0.0	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.6	2.4	2.4	2.4	2.4	2.4	2.3	0.7	0.0	0.0	0.0	0.0	0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	2.6	7.8	13.7	22.1	28.0	18.4	18.8	10.9	4.7	2.8	1.1	0.0	0.0	0.0	0.0
Yearling+ Smolt Emigration	Below DPD	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										0.0	0.0	0.0	0.0	0.0	0.0
	MRY	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										0.8	0.0	0.0	0.0	0.0	0.0

Spawning

Over the September through mid-October spawning lifestage period, the water temperature index value of 58°F is not exceeded at the Smartsville location with a 10 percent or greater probability. While adult spring-run Chinook salmon exhibit extended durations of holding near Daguerre Point Dam, they consistently move upstream into the reaches near the Smartsville Gage shortly before spawning, so this is the only location evaluated for the spawning lifestage.

Embryo Incubation

Over the September through December embryo incubation lifestage period, the water temperature index value of 58°F is not exceeded at the Smartsville location with a 10 percent or greater probability. Because spawning occurs primarily in upstream areas, embryo incubation also occurs primarily in upstream areas. This is why Smartsville is the only location evaluated for the embryo incubation lifestage.

Juvenile Rearing and Downstream Movement

Over the year-round juvenile rearing and downstream movement lifestage period, the water temperature index value of 65°F is not exceeded with a 10 percent or greater probability during any month of the year at the Daguerre Point Dam location, but is exceeded with a 11-28 percent probability from the last half of June through the first half of September at the Marysville

[29] Percent probability of mean daily temperature exceeding specified water temperature index values as estimated by the Project Daily Water Temperature Model.

location. However, over the 2007-2013 monitoring period, water temperatures at Marysville never exceeded or reached 65°F during any time of the year.

Yearling+ Smolt Emigration

Over the October through mid-May yearling+ smolt emigration lifestage period, the water temperature index value of 68°F is not exceeded at either the Daguerre Point Dam or Marysville locations.

Fall-run Chinook Salmon

Adult Immigration and Staging

Over the July through December adult immigration and staging lifestage period, the water temperature index value of 68°F is not exceeded with a 10 percent or greater probability at either the Daguerre Point Dam or Marysville locations (Table 7.4.2-5).

Table 7.4.2-5. Proposed Action modeled water temperature exceedances[1] for fall-run Chinook salmon lifestage- and location-specific periodicities in the lower Yuba River at Smartsville, Daguerre Point Dam, and Marysville.

Fall-run Chinook Salmon Lifestage	Node	Upper Tolerance WTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration and Staging	Below DPD	68°F													0.5	1.5	1.8	2.3	1.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0
	MRY	68°F													3.3	3.7	2.8	3.0	2.4	2.4	0.8	0.0	0.0	0.0	0.0	0.0
Spawning	SMRT	58°F																			2.4	2.4	1.5	0.0	0.0	0.0
	Below DPD	58°F																			50.7	11.6	2.1	0.0	0.0	0.0
Embryo Incubation	SMRT	58°F	0.0	0.0	0.0	0.0	0.0	0.0													2.4	2.4	1.5	0.0	0.0	0.0
	Below DPD	58°F	0.0	0.0	0.0	0.0	0.0	0.0													50.7	11.6	2.1	0.0	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.6												0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	2.6	7.8	13.7												0.0

1 Percent probability of mean daily water temperature exceeding specified water temperature index values as estimated by the Project Daily Water Temperature Model.

Spawning

Over the October through December spawning lifestage period, the water temperature index value of 58°F is not exceeded with a 10 percent or greater probability at the Smartsville location, although it is exceeded with a 51 percent probability at the Daguerre Point Dam location during the first half of October. However, fall-run Chinook salmon are primarily observed spawning during October in the upper reaches (upstream of Daguerre Point Dam) in the lower Yuba River. Spawning fall-run Chinook salmon begin expanding their spatial distribution further downstream in later fall months as suitable temperatures become available near or downstream of Daguerre Point Dam (RMT 2013).

Embryo Incubation

Over the October through March embryo incubation lifestage period, the water temperature index value of 58°F is not exceeded with a 10 percent or greater probability at the Smartsville location during any month evaluated, although it is exceeded with about a 51 percent probability at the Daguerre Point Dam location during the first half of October. Because fall-run Chinook salmon are primarily observed spawning during October in the upper reaches upstream of Daguerre Point Dam, that is also where incubation would occur. As described above for the spawning lifestage, also applicable to the embryo incubation lifestage, spawning fall-run Chinook salmon begin expanding their spatial distribution further downstream in later fall months as suitable temperatures become available near or downstream of Daguerre Point Dam (RMT 2013).

Juvenile Rearing and Downstream Movement

Over the late-December through June juvenile rearing and downstream movement lifestage period, the water temperature index value of 65°F is rarely exceeded at either the Daguerre Point Dam or Marysville locations during most months evaluated, but is exceeded with a 10 percent or greater probability during late June at the Marysville location.

7.4.2.3.2 Proposed Action Scenario Compared to the Environmental Baseline Scenario

Spring-run Chinook Salmon

Table 7.4.2-6 displays the differences in spring-run Chinook salmon lifestage-specific water temperature index value exceedance probabilities under the Proposed Action relative to the Environmental Baseline (i.e., the probability of exceeding a water temperature index value under the Proposed Action minus the probability of exceeding that water temperature index value under the Environmental Baseline).

Water temperature exceedance probabilities are generally similar under the Proposed Action and Environmental Baseline during the fall through spring months (i.e., October through May) for all lifestages of spring-run Chinook salmon. Some differences in simulated water temperatures occur during the spring-run Chinook salmon adult holding, and juvenile rearing and downstream movement lifestages. For all months of the year, no lifestage-specific water temperature index values are exceeded more often with a 10 percent or greater probability at any of the three evaluated locations under the Proposed Action, relative to the Environmental Baseline.

During the adult holding period extending from late June through mid-September, water temperatures at the Marysville Gage are somewhat higher under the Proposed Action compared to the Environmental Baseline. However, as previously discussed, adult spring-run Chinook salmon do not spend extended periods of time at downstream locations (e.g., Marysville), and they primarily exhibit holding behavior just downstream of Daguerre Point Dam or above Daguerre Point Dam.

Table 7.4.2-6. Difference in simulated water temperature exceedance probabilities for spring-run Chinook salmon lifestages under the Proposed Action relative to the Environmental Baseline.

Spring-run Chinook Salmon Lifestage	Node	Upper Tolerance WTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration	SMRT	68°F							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
	Below DPD	68°F							0.0	0.0	0.0	0.0	0.0	0.0	-1.1	-0.9	-0.7	-0.2	-1.1	-2.1						
	MRY	68°F							0.0	0.0	0.0	0.0	0.0	0.2	0.5	1.1	0.3	0.3	0.0	0.0						
Adult Holding	SMRT	65°F							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
	Below DPD	65°F							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2						
	MRY	65°F							-0.2	0.0	0.0	0.2	1.1	4.2	5.5	9.0	5.0	5.0	3.9	1.1						
Spawning	SMRT	58°F																	0.0	0.0	0.0					
Embryo Incubation	SMRT	58°F																	0.0	0.0	0.0	1.4	1.5	0.0	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.2	1.1	4.2	5.5	9.0	5.0	5.0	3.9	1.1	0.5	1.1	0.0	0.0	0.0	0.0
Yearling+ Smolt Emigration	Below DPD	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										0.0	0.0	0.0	0.0	0.0	0.0
	MRY	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										0.0	0.0	0.0	0.0	0.0	0.0

During the juvenile rearing and downstream movement lifestage, which extends year-round, water temperatures at the Marysville Gage are somewhat higher under the Proposed Action compared to the Environmental Baseline. However, over the 2007-2013 monitoring period, water temperatures at Marysville never exceeded or reached 65°F during any time of the year. Also, exposure of downstream migrating juveniles during summer months to water temperatures at Marysville would not be expected to substantially occur, because only minimal outmigration occurs during the summer, and because rearing temperatures further upstream in this reach below Daguerre Point Dam are suitable.

During the one conference year (WY 1977) included in the simulated period of evaluation (WY 1970-2010), water temperature differences between the Proposed Action and the Environmental Baseline demonstrate similar patterns among the three evaluation locations (Smartsville, Daguerre Point Dam and Marysville). Under the Proposed Action, water temperatures during the half-month periods are slightly higher (generally about 1% or less) from October through March than those under the Environmental Baseline. At Smartsville, water temperatures under the Proposed Action are slightly higher (generally about 1% or less) than those under the Environmental Baseline from April through September. However, at Daguerre Point Dam water temperatures under the Proposed Action generally become increasingly cooler from May through September, relative to the Environmental Baseline. This same pattern is observed at Marysville, although the magnitude of difference is greater, with temperatures under the Proposed Action ranging from about 7 to 11°F (8.2 to 13.5%) cooler than the Environmental Baseline. These cooler water temperatures under the Proposed Action would represent more suitable water temperatures during the summer, which includes portions of the spring-run Chinook salmon adult immigration and holding, and juvenile rearing and downstream movement lifestages.

Fall-run Chinook Salmon

Table 7.4.2-7 displays the differences in fall-run Chinook salmon lifestage-specific water temperature index value exceedance probabilities under the Proposed Action relative to the

Environmental Baseline (i.e., the probability of exceeding a water temperature index value under the Proposed Action minus the probability of exceeding that water temperature index value under the Environmental Baseline).

Water temperature exceedance probabilities are generally similar under the Proposed Action and Environmental Baseline during most all half-month periods of the year evaluated for lifestages of fall-run Chinook salmon, with the exception of early October, when water temperatures are exceeded for spawning and embryo incubation more often by 10 percent or more at the Daguerre Point Dam location. However, as previously discussed, fall-run Chinook salmon are primarily observed spawning during October in the upper reaches (upstream of Daguerre Point Dam) in the lower Yuba River. Spawning fall-run Chinook salmon begin expanding their spatial distribution further downstream in later fall months as suitable temperatures become available near or downstream of Daguerre Point Dam (RMT 2013).

Table 7.4.2-7. Difference in simulated water temperature exceedance probabilities for fall-run Chinook salmon lifestages under the Proposed Action scenario relative to the Environmental Baseline scenario.

Fall-run Chinook Salmon Lifestage	Node	Upper Tolerance WTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration and Staging	Below DPD	68°F													-1.1	-0.9	-0.7	-0.2	-1.1	-2.1	0.0	0.0	0.0	0.0	0.0	0.0
	MRY	68°F													0.5	1.1	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spawning	SMRT	58°F																			0.0	1.4	1.5	0.0	0.0	0.0
	Below DPD	58°F																			11.5	2.7	1.6	0.0	0.0	0.0
Embryo Incubation	SMRT	58°F	0.0	0.0	0.0	0.0	0.0	0.0													0.0	1.4	1.5	0.0	0.0	0.0
	Below DPD	58°F	0.0	0.0	0.0	0.0	0.0	0.0													11.5	2.7	1.6	0.0	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0												0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.2	1.1	4.2												0.0

As previously described, during the one conference year (WY 1977) included in the simulated period of evaluation (WY 1970-2010), water temperature differences between the Proposed Action and the Environmental Baseline demonstrate similar patterns among the three evaluation locations. Under the Proposed Action, cooler water temperatures at Daguerre Point Dam and Marysville would represent more suitable water temperatures during the summer, which includes portions of the fall-run Chinook salmon adult immigration and staging lifestage.

Under the Environmental Baseline, water temperatures represent a low stressor to Yuba River spring-run and fall-run Chinook salmon. Although relatively minor increases in simulated water temperatures with relatively low probabilities of occurrence are estimated to occur under the Proposed Action relative to the Environmental Baseline, this stressor remains characterized as low for Chinook salmon under the Proposed Action.

An additional analysis was undertaken comparing the Proposed Action to the Without-Project scenario (Table 7.4.2-8 and Table 7.4.2-9). Water temperature exceedance probabilities are generally similar under the Proposed Action and Without-Project scenario during the fall and winter months (i.e., late-November through March). Water temperatures under the Proposed

Action are substantially more suitable than those under the Without-Project scenario for the following lifestages and associated time periods.

- Spring-run Chinook Salmon
  - Adult Migration (July – September)
  - Adult Holding (June – September)
  - Spawning (September – mid October)
  - Embryo Incubation (September – mid November)
  - Juvenile Rearing and Downstream Movement (June – October)
  - Yearling+ Smolt Emigration (October)

- Fall-run Chinook Salmon
  - Adult Immigration and Staging (July – October)
  - Spawning (October – mid November)
  - Embryo Incubation (October – mid November)
  - Juvenile Rearing and Downstream Movement (late May - June)

Table 7.4.2-8. Difference in simulated water temperature exceedance probabilities for spring-run Chinook salmon lifestages under the Proposed Action, relative to the Without Project scenario.

Spring-run Chinook Salmon Lifestage	Node	Upper Tolerance WTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration	SMRT	68°F							0.0	0.0	0.0	0.0	0.0	-1.0	-24.7	-69.5	-100.0	-100.0	-100.0	-97.1						
	Below DPD	68°F							0.0	0.0	0.0	0.0	-5.4	-40.8	-76.3	-98.5	-98.2	-97.7	-98.7	-99.8						
	MRY	68°F							-2.3	-2.3	0.0	-5.3	-33.3	-61.1	-89.6	-96.3	-97.2	-97.0	-97.6	-97.6						
Adult Holding	SMRT	65°F							0.0	0.0	0.0	0.0	-0.2	-13.2	-53.2	-89.3	-100.0	-100.0	-100.0	-99.7						
	Below DPD	65°F							0.0	0.0	0.0	-0.6	-28.9	-58.5	-91.9	-97.6	-97.6	-97.6	-97.6	-97.7						
	MRY	65°F							-2.3	-2.3	-1.5	-13.6	-41.5	-59.8	-75.8	-72.0	-81.6	-81.3	-89.1	-95.3						
Spawning	SMRT	58°F																	-97.6	-97.6	-95.1					
Embryo Incubation	SMRT	58°F																	-97.6	-97.6	-95.1	-94.4	-44.6	-1.1	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	-28.9	-58.5	-91.9	-97.6	-97.6	-97.6	-97.6	-97.7	-96.9	-57.2	-1.8	0.0	0.0	0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	-2.3	-2.3	-1.5	-13.6	-41.5	-59.8	-75.8	-72.0	-81.6	-81.3	-89.1	-95.3	-96.9	-93.8	-9.3	0.0	0.0	0.0
Yearling+ Smolt Emigration	Below DPD	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										-89.8	-20.1	0.0	0.0	0.0	0.0
	MRY	68°F	0.0	0.0	0.0	0.0	0.0	0.0	-2.3	-2.3	0.0										-97.9	-86.3	-2.1	0.0	0.0	0.0

Table 7.4.2-9. Difference in simulated water temperature exceedance probabilities for fall-run Chinook salmon lifestages under the Proposed Action, relative to the Without Project scenario.

Fall-run Chinook Salmon Lifestage	Node	Upper Tolerance WTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration and Staging	Below DPD	68°F													-76.3	-98.5	-98.2	-97.7	-98.7	-99.8	-89.8	-20.1	0.0	0.0	0.0	0.0
	MRY	68°F													-89.6	-96.3	-97.2	-97.0	-97.6	-97.6	-97.9	-86.3	-2.1	0.0	0.0	0.0
Spawning	SMRT	58°F																			-95.1	-94.4	-44.6	-1.1	0.0	0.0
	Below DPD	58°F																			-46.8	-85.7	-62.4	-4.1	0.0	0.0
Embryo Incubation	SMRT	58°F	0.0	0.0	0.0	0.0	0.0	0.0													-95.1	-94.4	-44.6	-1.1	0.0	0.0
	Below DPD	58°F	0.0	0.0	0.0	0.0	0.0	0.0													-46.8	-85.7	-62.4	-4.1	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	-28.9	-58.5												0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	-2.3	-2.3	-1.5	-13.6	-41.5	-59.8												0.0

7.4.2.4 Narrows 2 Operations and Fish Movement

The Proposed Action does not include any changes to Narrows 2 operations, other than the previously described changes to conference year flows. Project FERC relicensing studies (Technical Memorandum 7-11) conducted to date indicate that adult anadromous salmonids (presumably including Chinook salmon) have not been observed entering the draft tube of Narrows 2. Additional analyses regarding Narrows 2 operations and fish movement prepared for this BA indicate that Narrows 2 flow releases do not appear to adversely influence adult spring-run Chinook salmon upstream migration, holding or spawning upstream of Daguerre Point Dam. At this time, Narrows 2 operations can be characterized as representing a low stressor to Chinook salmon. However, additional information regarding Narrows 2 operations as a stressor will be available when additional specific studies are completed during 2014.

7.4.2.5 Passage Impediments/Barriers

7.4.2.5.1 Englebright Dam

Because of the loss of historical spawning and rearing habitat above Englebright Dam, resultant loss of reproductive isolation and subsequent hybridization between spring-run and fall-run Chinook salmon, and restriction of spatial structure and associated vulnerability to catastrophic events, the existence of Englebright Dam represents a very high stressor to Yuba River Chinook salmon under the Environmental Baseline. Because the Proposed Action will not affect the magnitude of this stressor, the potential "exposure" of spring-run Chinook salmon to this stressor, or the effects of this stressor on EFH, it remains a very high stressor to Chinook salmon in the lower Yuba River.

7.4.2.5.2 Daguerre Point Dam

Under the Environmental Baseline, the entire suite of considerations associated with the design configuration and features of Daguerre Point Dam and its associated fish ladders, including issues identified regarding juvenile downstream passage, led to the conclusion that the effects associated with the presence of Daguerre Point Dam likely represent a medium to high stressor to Yuba River Chinook salmon. Because the Proposed Action will not affect the potential "exposure" of Chinook salmon to this stressor, the magnitude of this stressor, or the effects of this stressor on EFH, it remains a medium to high stressor to Chinook salmon in the lower Yuba River. The results of Study 7.13 – *Effects on Fish Facilities at Daguerre Point Dam* confirm that flows under the Environmental Baseline do not adversely affect the operation of the fish ladders at Daguerre Point Dam, and the Proposed Action would not sufficiently change flows, to affect the magnitude of this stressor.

7.4.2.6 Predation

Because predation of juvenile salmonids, including Chinook salmon, by introduced and native piscivorous fishes occurs throughout the lower Yuba River potentially at relatively high rates, predation likely represents a high stressor to the juvenile lifestage of Yuba River Chinook salmon under the Environmental Baseline. Because the Proposed Action will not affect the potential "exposure" of Chinook salmon to this stressor or the magnitude of this stressor, it remains a high stressor to Chinook salmon in the lower Yuba River.

7.4.2.6.1 Physical Habitat Alteration

Natural River Morphology and Function

The restricted availability of complex, diverse habitats such as multiple braided channels and side channels associated with the loss of natural river morphology and function represents a relatively high stressor to Yuba River Chinook salmon under the Environmental Baseline. Because the Proposed Action will not affect the potential "exposure" of Chinook salmon to this stressor, the magnitude of this stressor, or the effects of this stressor on EFH, it remains a relatively high stressor to Chinook salmon in the lower Yuba River.

Floodplain Habitat Availability

Under the Environmental Baseline, this stressor primarily affects one lifestage, inundation of floodplain habitat occurs relatively frequently compared to other Central Valley streams, inundation of floodplain habitat would not necessarily occur each year even under unaltered hydrologic conditions, and the lower Yuba River floodplain is comprised of unconsolidated alluvium without an abundance of characteristics associated with increased juvenile salmonid growth. Consequently, floodplain habitat availability was characterized as representing a medium stressor to Yuba River juvenile Chinook salmon under the Environmental Baseline. Because the Proposed Action will not affect the potential "exposure" of Chinook salmon to this stressor, the magnitude of this stressor, or the effects of this stressor on EFH, it remains a medium stressor to Chinook salmon in the lower Yuba River.

Riparian Habitat and Instream Cover (Riparian Vegetation, Instream Woody Material)

Under the Environmental Baseline, riparian vegetation and LWM, related primarily to the historical effects of upstream hydraulic mining on the channel geomorphology, provide habitat complexity and diversity, which potentially limits the productivity of juvenile salmonids, and the limited availability of riparian habitat and instream cover (in the form of LWM) is a stressor that is manifested every year. Consequently it was concluded that riparian habitat and instream cover represent a stressor of relatively high magnitude to Yuba River juvenile Chinook salmon. Because the Proposed Action will not affect the potential "exposure" of Chinook salmon to this stressor, the magnitude of this stressor, or the effects of this stressor on EFH, it remains a high stressor to Chinook salmon in the lower Yuba River.

7.4.2.7 Summary of EFH in the Yuba River Downstream of Englebright Dam

Overall, the Proposed Action would not eliminate, diminish, or disrupt EFH in the Yuba River downstream of Englebright Dam. The Proposed Action would not affect the potential exposure of Chinook salmon to stressors in the lower Yuba River under the existing conditions, nor would the Proposed Action change the magnitude of existing stressors. Although climate change was identified as a new threat during the 2011 5-Year review (PFMC 2011), effects on EFH that may result from climate change would not be attributable to the Proposed Action. Nevertheless, it is recognized that climate change will continue to be a stressor to EFH for Chinook salmon. Of the other 21 threats to Pacific salmon EFH identified in Amendment 14 of the FMP, the Proposed Action could potentially affect EFH through changes in flows and water temperatures in the Yuba River downstream of Englebright Dam. However, flow and water temperature-related effects on EFH downstream of Englebright Dam associated with the Proposed Action are expected to result in non-substantive effects, or beneficial effects.

7.5 Past, Present, and Reasonably Foreseeable Future Actions that Potentially Affect EFH in the Action Area (Cumulative Effects)

As defined in one of the EFH regulations, "*cumulative impacts are impacts on the environment that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes such actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time*" (50 C.F.R. § 600.815(a)(5)).

This regulation goes on to state that the cumulative assessment should include an "*assessement of the cumulative and synergistic effects of multiple threats, including the effects of natural stresses (such as storm damage or climate-based environmental shifts) and an assessment of the ecological risks resulting from the impact of those threats on EFH*" (50 C.F.R. § 600.815(a)(5)).

7.5.1 Past and Present Actions

Past and present actions contribute to the current condition of resources, and are intrinsically embedded in the baseline (i.e., existing aquatic conditions). These activities include harvesting, grazing, mining, operations and maintenance of the Corps' Englebright and Daguerre Point dams and water deliveries. Although these activities have the potential to affect the EFH in the Yuba River Watershed, they are outside the Commission's authority to regulate.

Timber harvesting and grazing, which occur both on Federal and private land, have the potential to affect EFH (i.e., both water quantity and water quality, including water temperatures, and riparian habitat) in the upper Yuba River Watershed.

Mining, which also occurs on both Federal and private land in the watershed, can affect water quality, especially metal contaminant concentrations. Most notably, historic hydraulic mining has had drastic effects on geology and soils in the Yuba River, especially on channel morphology, substrates and riparian vegetation. While these effects are most obvious in the Yuba River downstream of Englebright Dam, mining also has affected the watershed upstream of the dam, and consequently the EFH there.

The Corps' Englebright and Daguerre Point dams also affect Chinook salmon and EFH. Englebright Dam was constructed in 1941 to create a debris retention reservoir on the Yuba River that captures sediments produced by upstream hydraulic mining activities. Englebright Dam has been a complete barrier to upstream fish passage since its construction in 1941, and presently blocks access by anadromous salmonids to historically utilized habitat located upstream above the dam. The original purpose of the Daguerre Point Dam was to stabilize the Yuba River channel and to retain debris originating from hydraulic mining in the Yuba River watershed. As discussed in the Applicant-Prepared Draft BA, there are numerous issues associated with anadromous fish passage at Daguerre Point Dam. However, the Corps continues to operate the fish ladders at Daguerre Point Dam to provide fish passage for managed species, including Chinook salmon.

Non-project diversions and withdrawals by other users affect flows in Project-affected reaches. Upstream of the Project, NID and PG&E divert water for water deliveries and power generation. PG&E delivers some of the water that it diverts to NID and PCWA. Recent demands for water years 2001-2009 were about 139,000 acre-feet for NID and 105,000 acre-feet for PCWA. Most of NID's and PG&E's water rights are senior to, and thus have priority over, YCWA's water rights. Downstream of the Project, water diversions from the Yuba River may affect aquatic habitat conditions (e.g., water quantity, quality and water temperature) in the Yuba River downstream of Englebright Dam, and thus may affect EFH and managed species.

Other activities that could interact with the Project and may cumulatively adversely affect EFH include other multipurpose water projects in the Yuba River watershed, which are described in Section 3.1.1 of the DLA. FERC has the authority to regulate those projects.

7.5.2 Reasonably Foreseeable Future Actions

It is reasonable to assume that the past and present actions described above will continue in the future, although the magnitude of the actions may change. Timber harvesting and grazing are declining. Hydraulic mining was prohibited in the late 1800's, but other forms of mining continue. The Corps continues to operate and maintain Englebright and Daguerre Point dams. Reasonably foreseeable future actions are described separately for the Yuba River watershed upstream of Englebright Dam and for the river downstream of the dam.

Flows in the Middle Yuba River and South Yuba River, and many of their tributaries, have been regulated and diverted since the mid-1800s. Water diversions from the Middle and South Yuba River basins into the Bear River and American River basins were originally made to provide flows for hydraulic mining. The purposes of these diversions changed to agricultural and domestic purposes during the late 1800s and the early 1900s. Diversions from Slate Creek in the North Yuba River Basin into the Feather River Basin began in the 1960s. The owners of all of these upstream projects have submitted applications for renewals of their FERC licenses. The issuance of the new licenses and operations under them will result in changes to inflows to the Project from Slate Creek, the Middle Yuba River, and from the South Yuba River.

Model simulations of hydrologic and water temperature conditions were conducted as part of the analysis of cumulative effects in this Applicant-Prepared Draft EFH Assessment. A cumulative condition model scenario was developed, which is the same as the Proposed Action scenario with the following additions:

- South Feather Water and Power Agency's new FERC license conditions for flows on Slate Creek from the South Feather Project (FERC No. 2088)
- Nevada Irrigation District's (NID) new FERC license conditions for flows for the Yuba-Bear (YB) Project (FERC No. 2266)
- PG&E's new FERC license conditions for flows for the Drum-Spaulding (DS) Project (FERC No. 2310)
- Placer County Water Agency's (PCWA) projected 2062-level water supply demands
- NID's projected 2062-level water supply demands

The foregoing reasonably foreseeable future actions in the Yuba River watershed upstream of Englebright Reservoir have the potential to change instream flow and water temperature regimes in Project reaches. In addition, future-level demands for the Wheatland Water District (approximately 25 TAF/year of increased demand) in the Yuba River downstream of Englebright Dam have the potential to affect cumulative-condition flows and water temperatures. Hence this additional projected demand also is included in modeling of the cumulative scenario. The following analyses of EFH cumulative effects address flow and water temperature changes in the North Yuba River below New Bullards Bar, the Middle Yuba River above the confluence with the Yuba River, and the Yuba River upstream of Englebright Dam under the Cumulative Condition relative to existing conditions.

7.5.3 Yuba River Watershed Upstream of Englebright Dam

7.5.3.1 North Yuba River (New Bullards Bar Dam Reach)

Table 7.5.3-1 displays the long-term average flows and average flows by water year type in the New Bullards Bar Dam Reach of the North Yuba River under the Cumulative Condition, relative to the existing condition. Over the entire 33-year simulation period, long-term average flows in this reach of the North Yuba River would increase by 33.3 percent during July, increase between 85.7-100 percent from August through December, decrease between 8.3-18.9 percent during the January through May period, and decrease slightly (1.4%) during June under the Cumulative Condition scenario, relative to the existing condition scenario.

For wet water years, North Yuba River flows in this reach would increase substantially (85-100%) from August through December, and would generally decrease by about 14 percent (231 cfs) to 17 percent (ranging from 116 cfs to 329 cfs per month) for most months from January though July under the Cumulative Condition relative to the existing condition. During months exhibiting substantial flow increases, flows would generally double from about 7 cfs to 13-14 cfs.

For above normal water years, North Yuba River flows in this reach would increase substantially (100-133%) from July through November, increase slightly in May (2%) and February (8.8%), and decrease during the remaining months, with the greatest reduction occurring during April (26 cfs, or -50%). For the months exhibiting substantial flow increases, flows generally would double from about 6-7 cfs to 14 cfs.

For below normal water years, average monthly flows in the North Yuba River in this reach would not change during April, would decrease during May (50 cfs, or -18.8%) and June (13 cfs, or -65.0%), and would increase by 114.3 percent during all other months. For the months exhibiting substantial flow increases, flows generally would double from about 7 cfs to 15 cfs under the Cumulative Condition relative to the existing condition.

For dry and critically dry water years, and the one extreme critically dry water year (1977), average monthly flows would increase during all months under the Cumulative Condition relative to the existing condition. During dry water years, flows would generally increase by over 100 percent from July through March, and would increase by 16.7 percent from April through June. During critically dry water years, flows would double (from 6 cfs to 12 cfs) from July through February, increase by 83 percent (5 cfs) during March, and increase by 16.7 percent (1 cfs) from April through June under the Cumulative Condition relative to the existing condition. During extreme critically dry water years, flows would increase under the Cumulative Condition by 50 percent (3 cfs) from October through March, and would increase by 16.7 percent (1 cfs) from April through September.

Table 7.5.3-1. Long-term average flow and average flow by water year type in the New Bullards Bar Dam Reach of the North Yuba River under the Cumulative Condition, relative to the existing condition.

Analysis Period	Monthly Mean Flow (cfs)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-term												
Full Simulation Period[2]												
Cumulative Condition	14	14	305	400	395	467	142	319	207	16	13	13
Existing Condition	7	7	302	478	443	509	175	372	210	12	7	7
Difference	7.0	7.0	3.0	-78.0	-48.0	-42.0	-33.0	-53.0	-3.0	4.0	6.0	6.0
Percent Difference[3]	100.0	100.0	1.0	-16.3	-10.8	-8.3	-18.9	-14.2	-1.4	33.3	85.7	85.7
Water Year Types[1]												
Wet												
Cumulative Condition	14	14	851	1,544	1,398	1,549	545	879	801	24	13	13
Existing Condition	7	7	799	1,873	1,629	1,826	661	1,067	804	29	7	7
Difference	7.0	7.0	52.0	-329.0	-231.0	-277.0	-116.0	-188.0	-3.0	-5.0	6.0	6.0
Percent Difference[3]	100.0	100.0	6.5	-17.6	-14.2	-15.2	-17.5	-17.6	-0.4	-17.2	85.7	85.7
Above Normal												
Cumulative Condition	14	14	430	82	236	396	26	300	42	14	14	14
Existing Condition	6	6	494	96	217	296	52	294	43	7	7	7
Difference	8.0	8.0	-64.0	-14.0	19.0	100.0	-26.0	6.0	-1.0	7.0	7.0	7.0
Percent Difference[3]	133.3	133.3	-13.0	-14.6	8.8	33.8	-50.0	2.0	-2.3	100.0	100.0	100.0
Below Normal												
Cumulative Condition	15	15	15	15	15	15	7	216	7	15	15	15
Existing Condition	7	7	7	7	7	7	7	266	20	7	7	7
Difference	8.0	8.0	8.0	8.0	8.0	8.0	0.0	-50.0	-13.0	8.0	8.0	8.0
Percent Difference[3]	114.3	114.3	114.3	114.3	114.3	114.3	0.0	-18.8	-65.0	114.3	114.3	114.3
Dry												
Cumulative Condition	15	15	15	15	15	14	7	7	7	14	14	14
Existing Condition	7	7	7	7	7	7	6	6	6	6	6	6
Difference	8.0	8.0	8.0	8.0	8.0	7.0	1.0	1.0	1.0	8.0	8.0	8.0
Percent Difference[3]	114.3	114.3	114.3	114.3	114.3	100.0	16.7	16.7	16.7	133.3	133.3	133.3
Critically Dry												
Cumulative Condition	12	12	12	12	12	11	7	7	7	12	12	12
Existing Condition	6	6	6	6	6	6	6	6	6	6	6	6
Difference	6.0	6.0	6.0	6.0	6.0	5.0	1.0	1.0	1.0	6.0	6.0	6.0
Percent Difference[3]	100.0	100.0	100.0	100.0	100.0	83.3	16.7	16.7	16.7	100.0	100.0	100.0
Extreme Critically Dry												
Cumulative Condition	9	9	9	9	9	9	7	7	7	7	7	7
Existing Condition	6	6	6	6	6	6	6	6	6	6	6	6
Difference	3.0	3.0	3.0	3.0	3.0	3.0	1.0	1.0	1.0	1.0	1.0	1.0
Percent Difference[3]	50.0	50.0	50.0	50.0	50.0	50.0	16.7	16.7	16.7	16.7	16.7	16.7

[1] As defined by the "Smartsville Index" described in Exhibit E2

[2] Based on a 33-year simulation period

[3] Relative difference of the monthly average

Table 7.5.3-2 displays the long-term average water temperatures and average water temperatures by water year type in the New Bullards Bar Reach of the North Yuba River under the Cumulative Condition, relative to the existing condition. Over the 33-year simulation period, the long-term average monthly water temperatures in the New Bullards Bar Dam Reach of the North Yuba River would be essentially equivalent from October through March, and would change slightly from April through September under the Cumulative Condition, relative to the existing condition. Long-term average monthly water temperatures would be essentially equivalent (i.e., a change of 0.3°F or less) during October through March, and would slightly decrease during April through September under the Cumulative Condition scenario relative to the existing condition scenario.

Table 7.5.3-2. Long-term average water temperature and average water temperature by water year type in the New Bullards Bar Dam Reach of the North Yuba River under the Cumulative Condition, relative to the existing condition.

Analysis Period	Monthly Mean Water Temperature (ºF)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-term												
Full Simulation Period[2]												
Cumulative Condition	44.5	44.6	44.8	44.5	44.1	43.9	43.9	44.2	44.3	44.1	44.2	44.3
Existing Condition	44.8	44.7	44.8	44.6	44.3	44.2	44.3	44.7	44.9	44.9	44.8	44.8
Difference	-0.3	-0.1	0.0	-0.1	-0.2	-0.3	-0.4	-0.5	-0.6	-0.8	-0.6	-0.5
Water Year Types[1]												
Wet												
Cumulative Condition	44.2	44.4	44.7	44.4	44.2	44.3	44.0	44.8	45.4	44.3	44.4	44.4
Existing Condition	44.5	44.5	44.7	44.5	44.3	44.4	44.3	45.3	45.8	45.0	45.0	44.9
Difference	-0.3	-0.1	0.0	-0.1	-0.1	-0.1	-0.3	-0.5	-0.4	-0.7	-0.6	-0.5
Above Normal												
Cumulative Condition	44.9	45.0	45.3	44.7	44.4	44.3	44.0	44.3	44.1	44.2	44.2	44.3
Existing Condition	45.2	45.2	45.3	44.8	44.6	44.4	44.4	44.8	44.8	44.9	44.8	44.8
Difference	-0.3	-0.2	0.0	-0.1	-0.2	-0.1	-0.4	-0.5	-0.7	-0.7	-0.6	-0.5
Below Normal												
Cumulative Condition	44.0	44.1	44.2	44.0	43.5	43.2	43.3	43.5	43.4	43.5	43.6	43.8
Existing Condition	44.2	44.2	44.1	44.0	43.6	43.5	43.6	44.1	44.1	44.2	44.2	44.2
Difference	-0.2	-0.1	0.1	0.0	-0.1	-0.3	-0.3	-0.6	-0.7	-0.7	-0.6	-0.4
Dry												
Cumulative Condition	44.4	44.6	44.7	44.7	44.3	44.0	44.1	44.2	44.2	44.3	44.4	44.5
Existing Condition	44.6	44.6	44.6	44.7	44.4	44.2	44.5	44.7	44.9	45.0	45.0	44.9
Difference	-0.2	0.0	0.1	0.0	-0.1	-0.2	-0.4	-0.5	-0.7	-0.7	-0.6	-0.4
Critically Dry												
Cumulative Condition	46.0	46.0	45.4	44.5	43.7	43.3	43.4	43.5	43.6	43.7	43.7	43.8
Existing Condition	45.4	45.4	45.3	44.8	44.2	44.0	44.2	44.4	44.6	44.8	44.7	44.7
Difference	0.6	0.6	0.1	-0.3	-0.5	-0.7	-0.8	-0.9	-1.0	-1.1	-1.0	-0.9
Extreme Critically Dry												
Cumulative Condition	45.0	45.1	45.1	45.0	44.5	44.2	44.4	44.6	44.8	44.9	45.0	45.1
Existing Condition	46.0	45.9	45.7	45.4	44.8	44.7	45.0	45.2	45.6	45.8	45.9	45.8
Difference	-1.0	-0.8	-0.6	-0.4	-0.3	-0.5	-0.6	-0.6	-0.8	-0.9	-0.9	-0.7

[1] As defined by the "Smartsville Index" described in Exhibit E2

[2] Based on a 33-year simulation period

For wet water year types, average monthly water temperatures in the New Bullards Bar Dam Reach of the North Yuba River would decrease slightly during all months of the year, but would be essentially equivalent during October through April under the Cumulative Condition scenario relative to the existing condition scenario.

For above normal water year types, average monthly water temperatures in the New Bullards Bar Dam Reach of the North Yuba River would decrease slightly during all months of the year (with the exception of December, when no change would occur), but would be essentially equivalent during October through March under the Cumulative Condition scenario relative to the existing condition scenario.

For below normal water year types, average monthly water temperatures in the New Bullards Bar Dam Reach of the North Yuba River would decrease slightly during most months of the year, and would be essentially equivalent during October through April under the Cumulative Condition scenario relative to the existing condition scenario.

For dry water year types, average monthly water temperatures in the New Bullards Bar Dam Reach of the North Yuba River would be essentially equivalent during October through March, and would decrease during April through September under the Cumulative Condition scenario relative to the existing condition scenario.

For critically dry water year types, average monthly water temperatures in the New Bullards Bar Dam Reach of the North Yuba River would be essentially equivalent during December and January, would increase during October and November, and would decrease during February through September under the Cumulative Condition scenario relative to the existing condition scenario.

For the one extreme critically dry water year (1977), average monthly water temperatures in the New Bullards Bar Dam Reach of the North Yuba River would decrease slightly during all months of the year, and would be essentially equivalent during February, under the Cumulative Condition scenario relative to the existing condition scenario.

During the July through December fall-run Chinook salmon adult immigration and staging period, unoccupied EFH habitat in the New Bullards Bar Reach of the North Yuba River would be slightly more suitable under the Cumulative Condition, relative to the existing condition. Although releases from New Bullards Bar Dam would generally double the volume of flow in the river during most months, long-term average monthly flow increases would generally only range between 4 to 7 cfs. However, the habitat benefits due to increased flow associated with the Proposed Action would occur during all water year types. Water temperatures under both the Cumulative Condition and the existing condition during all months would not exceed the upper tolerance WTI of 68°F for this lifestage.

Considering these changes in long-term average flows, unoccupied EFH habitat in the New Bullards Bar Reach of the North Yuba River during the fall-run Chinook salmon spawning and embryo incubation period (October through March) under the Cumulative Condition, relative to the existing condition, generally would be slightly more suitable from October through December and slightly less suitable from January through March. Although releases from New Bullards Bar Dam would generally double the volume of flow in the river during most months of the October through December period, average monthly flow increases would only be about 6 to 7 cfs, depending on the water year type. Although flow reductions that would occur from January through March during wet years influence the long-term average, flows during the same months in drier water year types would generally increase under the Cumulative Condition, relative to the existing condition. Water temperatures under both the Cumulative Condition and the existing condition would not exceed the upper tolerance WTI of 58°F for this lifestage.

During the December through June fall-run Chinook salmon juvenile rearing and downstream movement period, unoccupied EFH habitat in the New Bullards Bar Reach of the North Yuba River could be slightly less suitable under the Cumulative Condition, relative to the existing condition because long-term average flows decreases >10 percent would occur during January, February, April and May. The reductions in long-term average monthly flow are primarily influenced by flow reductions that would occur during wet years. However, flows during other water year types would increase during most months under the Cumulative Condition, relative to the existing condition. Water temperatures under both the Cumulative Condition and the existing condition would not exceed the upper tolerance WTI of 65°F for this lifestage.

Considering these changes in long-term average flows, unoccupied EFH habitat in the New Bullards Bar Reach of the North Yuba River during the April through September spring-run Chinook salmon adult immigration and holding period would be slightly less suitable from April through June, and slightly more suitable from July through September under the Cumulative Condition, relative to the existing condition. Average monthly flows would increase during all months and water years, except for a few months (April through July) during wet years, April and June during above normal years, and May and June during below normal years. Water temperatures under both the Cumulative Condition and the existing condition would not exceed the upper tolerance WTI of 68°F for immigration or the upper tolerance WTI of 65°F for holding.

During the September through December spring-run Chinook salmon spawning and embryo incubation period, unoccupied EFH habitat in the New Bullards Bar Reach of the North Yuba River would be more suitable under the Cumulative Condition, relative to the existing condition. Water temperatures under both the Cumulative Condition and the existing condition would not exceed the upper tolerance WTI of 58°F for this lifestage.

Considering these changes in long-term average flows during the year-round spring-run Chinook salmon juvenile rearing and downstream movement period, unoccupied EFH habitat in the New Bullards Bar Reach of the North Yuba River would be slightly more suitable from July through December, and slightly less suitable from January through June. During dry, critically dry and the one extreme critically dry water year (1977), flows under the Cumulative Condition would increase during all months, relative to the existing condition. Water temperatures under both the Cumulative Condition and the existing condition would not exceed the upper tolerance WTI of 65°F for this lifestage.

7.5.3.2 Middle Yuba River above the Confluence with the North Yuba River

Table 7.5.3-3 displays the long-term average flows and average flows by water year type in the Middle Yuba River downstream of Our House Dam and upstream of the confluence with the North Yuba River under the Cumulative Condition, relative to the existing condition. Over the entire 33-year simulation period, long-term average flows in this reach of the Middle Yuba River would increase during all months, with the largest increases occurring during June (45 cfs, or 39.5%) and July (25 cfs, or 53.2%) under the Cumulative Condition scenario, relative to the existing condition scenario.

For wet water years, flows in this reach of the Middle Yuba River would increase during all months except May (-4.9% decrease). Over the entire year, flow increases would range from 7 cfs (October) to 239 cfs (February). The largest flow increases would occur during the summer when flows would increase between 22 percent (June) and 93.2 percent (July) under the Cumulative Condition scenario, relative to the existing condition scenario.

For above normal water years, flows in this reach of the Middle Yuba River would increase during all months of the year, with increases ranging from 3.1 percent (November) up to 84.3 percent (June). The largest flow increases would generally occur in May (82 cfs, or 31.1%), June (70 cfs, or 84.3%), July (32 cfs, or 64%), August (12 cfs, or 26.1%) and September (10 cfs, or 22.2%) under the Cumulative Condition scenario, relative to the existing condition scenario.

For below normal water years, average monthly flows in this reach of the Middle Yuba River would increase during all months of the year, with increases ranging from 2.6 percent (September) to 75.6 percent (June) under the Cumulative Condition scenario relative to the existing condition scenario.

Table 7.5.3-3. Long-term average flow and average flow by water year type in the Middle Yuba River above the confluence with the North Yuba River under the Cumulative Condition, relative to the existing condition.

Analysis Period	Monthly Mean Flow (cfs)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-term												
Full Simulation Period²												
Cumulative Condition	49	112	334	476	538	461	330	296	159	72	47	43
Existing Condition	43	102	294	433	454	405	294	279	114	47	40	39
Difference	6.0	10.0	40.0	43.0	84.0	56.0	36.0	17.0	45.0	25.0	7.0	4.0
Percent Difference³	14.0	9.8	13.6	9.9	18.5	13.8	12.2	6.1	39.5	53.2	17.5	10.3
Water Year Types¹												
Wet												
Cumulative Condition	56	174	809	1,250	1,328	846	742	557	305	114	64	59
Existing Condition	49	164	748	1,195	1,089	796	700	586	250	59	47	46
Difference	7.0	10.0	61.0	55.0	239.0	50.0	42.0	-29.0	55.0	55.0	17.0	13.0
Percent Difference³	14.3	6.1	8.2	4.6	21.9	6.3	6.0	-4.9	22.0	93.2	36.2	28.3
Above Normal												
Cumulative Condition	51	164	409	503	601	637	304	346	153	82	58	55
Existing Condition	38	159	336	426	555	565	247	264	83	50	46	45
Difference	13.0	5.0	73.0	77.0	46.0	72.0	57.0	82.0	70.0	32.0	12.0	10.0
Percent Difference³	34.2	3.1	21.7	18.1	8.3	12.7	23.1	31.1	84.3	64.0	26.1	22.2
Below Normal												
Cumulative Condition	42	82	126	172	191	270	222	291	144	66	46	40
Existing Condition	38	64	103	140	152	201	186	273	82	47	42	39
Difference	4.0	18.0	23.0	32.0	39.0	69.0	36.0	18.0	62.0	19.0	4.0	1.0
Percent Difference³	10.5	28.1	22.3	22.9	25.7	34.3	19.4	6.6	75.6	40.4	9.5	2.6
Dry												
Cumulative Condition	49	57	76	95	170	225	140	104	77	45	31	29
Existing Condition	45	49	59	73	142	177	116	92	61	40	32	30
Difference	4.0	8.0	17.0	22.0	28.0	48.0	24.0	12.0	16.0	5.0	-1.0	-1.0
Percent Difference³	8.9	16.3	28.8	30.1	19.7	27.1	20.7	13.0	26.2	12.5	-3.1	-3.3
Critically Dry												
Cumulative Condition	47	69	111	126	117	141	106	85	68	35	29	25
Existing Condition	43	52	89	104	86	104	83	71	49	34	31	28
Difference	4.0	17.0	22.0	22.0	31.0	37.0	23.0	14.0	19.0	1.0	-2.0	-3.0
Percent Difference³	9.3	32.7	24.7	21.2	36.0	35.6	27.7	19.7	38.8	2.9	-6.5	-10.7
Extreme Critically Dry												
Cumulative Condition	22	27	24	38	43	59	41	56	32	13	10	15
Existing Condition	31	34	31	38	41	45	49	72	44	21	16	19
Difference	-9.0	-7.0	-7.0	0.0	2.0	14.0	-8.0	-16.0	-12.0	-8.0	-6.0	-4.0
Percent Difference³	-29.0	-20.6	-22.6	0.0	4.9	31.1	-16.3	-22.2	-27.3	-38.1	-37.5	-21.1

1 As defined by the "Smartsville Index" described in Exhibit E2

2 Based on a 33-year simulation period

3 Relative difference of the monthly average

For dry water years, average monthly flows in this reach of the Middle Yuba River would increase during all months of the year, except for August (-3.1%) and September (-3.3%). During dry years, flow increases would range from 8.9 percent (October) up to 30.1 percent (January) under the Cumulative Condition scenario relative to the existing condition scenario.

For critically dry water years, average monthly flows in this reach of the Middle Yuba River would increase during all months of the year, except for August (-6.5%) and September (-10.7%). During critically dry years, flow increases would range from 2.9 percent (July) up to 36.0 percent (February) under the Cumulative Condition scenario relative to the existing condition scenario.

For the one extreme critically dry water year (1977), average monthly flows in this reach of the Middle Yuba River would increase during February (4.9%) and March (31.1%), remain the same during January, and decrease from April through December under the Cumulative Condition scenario relative to the existing condition. Flow decreases would range from -16.3 percent (8 cfs) during April to -38.1 percent (8 cfs) during July under the Cumulative Condition relative to the existing condition scenario.

Table 7.5.3-4 displays the long-term average water temperatures and average water temperatures by water year type in the Middle Yuba River above the confluence with the North Yuba River under the Cumulative Condition scenario, relative to the existing condition scenario. Over the 33-year simulation period, the long-term average monthly water temperatures in this reach of the Middle Yuba River would be essentially equivalent during October through January, and would decrease during February through September under the Cumulative Condition scenario, relative to the existing condition scenario.

For wet water year types, average monthly water temperatures in the Middle Yuba River above the confluence with the North Yuba River would be essentially equivalent during October through January, and would decrease during February through September under the Cumulative Condition scenario, relative to the existing condition scenario.

For above normal water year types, average monthly water temperatures in the Middle Yuba River above the confluence with the North Yuba River would be essentially equivalent during November through January, and would decrease during February through October under the Cumulative Condition scenario, relative to the existing condition scenario.

For below normal water year types, average monthly water temperatures in the Middle Yuba River above the confluence with the North Yuba River would be essentially equivalent during October through January, and would decrease during February through September under the Cumulative Condition scenario, relative to the existing condition scenario.

For dry water year types, average monthly water temperatures in the Middle Yuba River above the confluence with the North Yuba River would be essentially equivalent during October through January, and would decrease during February through September under the Cumulative Condition scenario, relative to the existing condition scenario.

For critically dry water year types, average monthly water temperatures in the Middle Yuba River above the confluence with the North Yuba River would be essentially equivalent during

October through January, and would decrease during February through September under the Cumulative Condition scenario relative to the existing condition scenario.

For the one extreme critically dry water year (1977), average monthly water temperatures in the Middle Yuba River above the confluence with the North Yuba River would be essentially equivalent during November through January, and would decrease during February through October under the Cumulative Condition scenario relative to the existing condition scenario.

Table 7.5.3-4. Long-term average water temperature and average water temperature by water year type in the Middle Yuba River above the confluence with the North Yuba River under the Cumulative Condition, relative to the existing condition.

Analysis Period	Monthly Mean Water Temperature (ºF)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-term												
Full Simulation Period[2]												
Cumulative Condition	56.8	45.1	39.3	39.2	42.0	46.4	51.0	57.1	66.4	75.7	73.8	67.5
Existing Condition	57.1	45.1	39.1	39.0	42.7	48.1	53.5	60.0	70.1	78.1	75.2	68.4
Difference	-0.3	0.0	0.2	0.2	-0.7	-1.7	-2.5	-2.9	-3.7	-2.4	-1.4	-0.9
Water Year Types[1]												
Wet												
Cumulative Condition	56.4	44.9	39.2	41.1	43.9	46.2	48.5	52.3	61.2	74.7	73.2	66.1
Existing Condition	56.7	44.9	39.0	40.8	44.3	47.4	50.3	54.5	65.7	77.6	75.1	67.4
Difference	-0.3	0.0	0.2	0.3	-0.4	-1.2	-1.8	-2.2	-4.5	-2.9	-1.9	-1.3
Above Normal												
Cumulative Condition	57.3	45.5	40.2	40.4	43.1	46.5	50.1	55.1	64.1	75.5	73.5	67.0
Existing Condition	57.7	45.6	39.9	40.3	43.6	48.1	52.8	58.8	68.6	78.0	75.0	68.0
Difference	-0.4	-0.1	0.3	0.1	-0.5	-1.6	-2.7	-3.7	-4.5	-2.5	-1.5	-1.0
Below Normal												
Cumulative Condition	56.5	44.8	38.8	37.9	40.5	46.1	51.7	59.2	69.2	76.8	74.6	68.5
Existing Condition	56.5	44.8	38.5	37.7	41.4	48.1	54.2	61.9	72.6	79.0	75.7	69.2
Difference	0.0	0.0	0.3	0.2	-0.9	-2.0	-2.5	-2.7	-3.4	-2.2	-1.1	-0.7
Dry												
Cumulative Condition	57.0	45.2	39.3	37.9	40.7	46.4	52.8	60.7	69.7	76.2	74.2	68.3
Existing Condition	57.3	45.3	39.0	37.8	41.6	48.4	55.7	63.9	72.5	78.1	75.3	69.0
Difference	-0.3	-0.1	0.3	0.1	-0.9	-2.0	-2.9	-3.2	-2.8	-1.9	-1.1	-0.7
Critically Dry												
Cumulative Condition	56.9	45.0	39.6	38.3	41.2	46.9	52.1	60.4	69.6	76.6	73.8	68.2
Existing Condition	57.2	44.9	39.3	38.3	42.4	49.2	54.6	63.6	72.4	78.7	74.7	68.9
Difference	-0.3	0.1	0.3	0.0	-1.2	-2.3	-2.5	-3.2	-2.8	-2.1	-0.9	-0.7
Extreme Critically Dry												
Cumulative Condition	55.8	45.5	37.6	36.6	41.1	46.4	53.9	58.6	70.0	73.5	70.9	66.2
Existing Condition	56.7	45.6	37.3	36.3	42.4	47.9	56.6	60.7	72.8	76.7	74.4	68.2
Difference	-0.9	-0.1	0.3	0.3	-1.3	-1.5	-2.7	-2.1	-2.8	-3.2	-3.5	-2.0

[1] As defined by the "Smartsville Index" described in Exhibit E2

[2] Based on a 33-year simulation period

Considering these changes in long-term average flows, unoccupied EFH habitat in the Middle Yuba River between Our House Dam and the confluence with the North Yuba River during the July through December fall-run Chinook salmon adult immigration and staging period would be slightly more suitable under the Cumulative Condition, relative to the existing condition. Habitat benefits due to increased average monthly flow would generally occur during all water year types except for the extreme critically dry year (1977). Long-term average water temperatures under both the Cumulative Condition and the existing condition would exceed 68°F from July through September. Although average monthly water temperatures under the Cumulative Condition would decrease by several degrees in the summer during all water years, the reductions would not be sufficient to achieve the upper tolerable WTI of 68°F during July and August of any water year, relative to the existing condition.

Considering these changes in long-term average flows, unoccupied EFH habitat in this reach of the Middle Yuba River during the fall-run Chinook salmon spawning and embryo incubation period (October through March) would be slightly more suitable under the Cumulative Condition, relative to the existing condition. Except for October through December of the extreme critically dry year (1977), average monthly flows by water year type would increase slightly under the Cumulative Condition, relative to the existing condition. Water temperatures under both the Cumulative Condition and the existing condition would not exceed the upper tolerance WTI of 58°F for this lifestage.

During the fall-run Chinook salmon juvenile rearing and downstream movement period (December through June), unoccupied EFH habitat in this reach of the Middle Yuba River could be slightly more suitable under the Cumulative Condition, relative to the existing condition. Modeled reductions in long-term average monthly flow are primarily influenced by flow reductions during wet years. However, flows during other water year types would increase during most months under the Cumulative Condition, relative to the existing condition. Except for June of some years, long-term average and average water temperatures by water year type would not exceed the upper tolerance WTI value of 65°F for this lifestage under the Cumulative Condition and the existing condition. During June of below normal, dry, critically dry and the extreme critically dry year (1977), Cumulative Condition scenario water temperatures would be less than the existing condition, but neither scenario would achieve monthly mean June water temperatures of less than the upper tolerance WTI value of 65°F.

Considering these changes in long-term average flows, unoccupied EFH habitat in this reach of the Middle Yuba River during the April through September spring-run Chinook salmon adult immigration and holding period could be slightly more suitable under the Cumulative Condition, relative to the existing condition. Average monthly flows under the Cumulative Condition would generally increase during most months and water years, except for the extreme critically dry year (1977) and August and September during dry and critically dry years. Although long-term average water temperatures would be reduced between 1.3°F and 5.3°F under the Cumulative Condition compared to the existing condition, neither scenario would be reduced below the upper tolerance WTI of 65°F for holding from June through September, nor the upper tolerance WTI of 68°F for immigration during July and August.

During the September through December spring-run Chinook salmon spawning and embryo incubation period, unoccupied EFH habitat in this reach of the Middle Yuba River could be slightly more suitable under the Cumulative Condition, relative to the existing condition. Although average monthly water temperatures would be reduced between 1.0°F and 2.9°F under the Cumulative Condition scenario compared to the existing condition scenario during September, neither scenario would achieve monthly mean water temperatures of less than the upper tolerance WTI of 58°F during any water year. Water temperatures under both the Cumulative Condition and the existing condition scenarios would not exceed 58°F from October through December.

Considering these changes in long-term average flows during the year-round spring-run Chinook salmon juvenile rearing and downstream movement period, unoccupied EFH habitat in this reach of the Middle Yuba River could be slightly more suitable under the Cumulative Condition, relative to the existing condition. Except for the one extreme critically dry year (1977), flows would generally be slightly higher during most months and water years under the Cumulative Condition, relative to the existing condition. Although long-term average water temperatures would be reduced between 1.3°F and 5.3°F under the Cumulative Condition scenario compared to the existing condition scenario, neither scenario would achieve mean monthly water temperatures less than the upper tolerance WTI of 65°F for this lifestage from June through September. During the remaining months, water temperatures under both the Cumulative Condition and the existing condition would not exceed 65°F.

7.5.3.3 Yuba River Upstream of Englebright Reservoir

Table 7.5.3-5 displays the long-term average flows and average flows by water year type in the Yuba River below the New Colgate Powerhouse under the Cumulative Condition, relative to the existing condition. Over the entire 33-year simulation period, long-term average flows in the Yuba River would change slightly during all months of the year, with minor increases during December through February, and June through August, and with minor decreases during September through November, and March through May, under the Cumulative Condition scenario relative to the existing condition scenario.

For wet water years, average monthly Yuba River flows below the New Colgate Powerhouse would increase slightly during December, February and August, and decrease slightly during September through November, January, and March through July, under the Cumulative Condition scenario relative to the existing condition scenario.

For above normal water years, average monthly Yuba River flows below the New Colgate Powerhouse would increase slightly during December through February, and June through August, and decrease slightly during September through November, and March through May, under the Cumulative Condition scenario relative to the existing condition scenario.

For below normal water years, average monthly flows in the Yuba River below the New Colgate Powerhouse would increase during December through April, and June through September, with a substantial increase occurring only during January (19.3%). Average monthly flows would decrease slightly during October, November and May, under the Cumulative Condition scenario relative to the existing condition scenario.

During dry water years, average monthly flows in the Yuba River below the New Colgate Powerhouse would increase slightly during January through March, and June through August, and would decrease slightly during September through December, April and May, under the Cumulative Condition scenario relative to the existing condition scenario.

During critically dry water years, average monthly flows in the Yuba River below the New Colgate Powerhouse would increase slightly during January, and June through August, and would decrease slightly during September through December, and February through May, under the Cumulative Condition scenario relative to the existing condition scenario.

During the one extremely critically dry water year (1977), average monthly flows in the Yuba River below the New Colgate Powerhouse would increase during April, and June through September, with substantial increases during April (15.6%), July (16.0%), August (20.5%), and September (141.3%). Average monthly flows would decrease slightly during October through March, and May, under the Cumulative Condition scenario relative to the existing condition scenario.

Table 7.5.3-5. Long-term average flow and average flow by water year type in the Yuba River below the New Colgate Powerhouse under the Cumulative Condition, relative to the existing condition.

Analysis Period	Monthly Mean Flow (cfs)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-term												
Full Simulation Period[2]												
Cumulative Condition	751	894	1,627	2,414	2,764	2,648	1,929	2,575	2,504	1,940	1,574	803
Existing Condition	784	921	1,575	2,360	2,672	2,677	2,055	2,772	2,477	1,903	1,531	805
Difference	-33.0	-27.0	52.0	54.0	92.0	-29.0	-126.0	-197.0	27.0	37.0	43.0	-2.0
Percent Difference[3]	-4.2	-2.9	3.3	2.3	3.4	-1.1	-6.1	-7.1	1.1	1.9	2.8	-0.2
Water Year Types[1]												
Wet												
Cumulative Condition	760	1,010	3,315	5,631	6,221	5,737	3,746	4,310	4,026	2,661	2,322	916
Existing Condition	793	1,035	3,147	5,743	6,075	5,934	4,005	4,652	4,066	2,694	2,266	929
Difference	-33.0	-25.0	168.0	-112.0	146.0	-197.0	-259.0	-342.0	-40.0	-33.0	56.0	-13.0
Percent Difference[3]	-4.2	-2.4	5.3	-2.0	2.4	-3.3	-6.5	-7.4	-1.0	-1.2	2.5	-1.4
Above Normal												
Cumulative Condition	755	1,083	2,043	2,063	3,336	3,870	2,402	3,045	2,955	2,253	1,648	838
Existing Condition	787	1,115	1,998	1,993	3,228	3,896	2,645	3,232	2,920	2,142	1,616	857
Difference	-32.0	-32.0	45.0	70.0	108.0	-26.0	-243.0	-187.0	35.0	111.0	32.0	-19.0
Percent Difference[3]	-4.1	-2.9	2.3	3.5	3.3	-0.7	-9.2	-5.8	1.2	5.2	2.0	-2.2
Below Normal												
Cumulative Condition	756	792	885	1,831	1,505	1,222	1,441	2,477	2,397	1,841	1,457	831
Existing Condition	785	802	840	1,535	1,414	1,155	1,410	2,728	2,314	1,799	1,407	823
Difference	-29.0	-10.0	45.0	296.0	91.0	67.0	31.0	-251.0	83.0	42.0	50.0	8.0
Percent Difference[3]	-3.7	-1.2	5.4	19.3	6.4	5.8	2.2	-9.2	3.6	2.3	3.6	1.0
Dry												
Cumulative Condition	752	738	617	793	823	606	714	1,270	1,362	1,394	1,161	728
Existing Condition	783	768	635	745	756	553	775	1,369	1,315	1,362	1,129	742
Difference	-31.0	-30.0	-18.0	48.0	67.0	53.0	-61.0	-99.0	47.0	32.0	32.0	-14.0
Percent Difference[3]	-4.0	-3.9	-2.8	6.4	8.9	9.6	-7.9	-7.2	3.6	2.3	2.8	-1.9
Critically Dry												
Cumulative Condition	695	831	683	720	601	515	699	1,212	1,228	1,368	1,082	657
Existing Condition	766	888	684	716	621	538	741	1,223	1,209	1,331	1,047	665
Difference	-71.0	-57.0	-1.0	4.0	-20.0	-23.0	-42.0	-11.0	19.0	37.0	35.0	-8.0
Percent Difference[3]	-9.3	-6.4	-0.1	0.6	-3.2	-4.3	-5.7	-0.9	1.6	2.8	3.3	-1.2
Extreme Critically Dry												
Cumulative Condition	722	795	652	601	594	583	407	484	650	625	482	456
Existing Condition	745	803	675	630	620	611	352	498	649	539	400	189
Difference	-23.0	-8.0	-23.0	-29.0	-26.0	-28.0	55.0	-14.0	1.0	86.0	82.0	267.0
Percent Difference[3]	-3.1	-1.0	-3.4	-4.6	-4.2	-4.6	15.6	-2.8	0.2	16.0	20.5	141.3

[1] As defined by the "Smartsville Index" described in Exhibit E2

[2] Based on a 33-year simulation period

[3] Relative difference of the monthly average

Table 7.5.3-6 displays the long-term average water temperatures and average water temperatures by water year type in the Yuba River below New Colgate Powerhouse under the Cumulative Condition scenario, relative to the existing condition scenario. Over the entire 33-year simulation period, the long-term average monthly water temperatures under the Cumulative Condition scenario relative to the existing condition scenario would be essentially equivalent during January through November, and would be higher during December, under the Cumulative Condition scenario, relative to the existing condition scenario.

For wet water year types, average monthly water temperatures in the Yuba River below the New Colgate Powerhouse would be essentially equivalent during August through May, and would be somewhat higher during June and July, under the Cumulative Condition scenario relative to the existing condition scenario.

For above normal water year types, average monthly water temperatures in the Yuba River below the New Colgate Powerhouse would be essentially equivalent during October, November, January through April, and June through September, would increase slightly during May, and would decrease slightly during December, under the Cumulative Condition scenario relative to the existing condition scenario.

For below normal water year types, average monthly water temperatures in the Yuba River below the New Colgate Powerhouse would be essentially equivalent during all months of the year, with the exception of during April, when water temperatures would decrease slightly, under the Cumulative Condition scenario relative to the existing condition scenario.

For dry water year types, average monthly water temperatures in the Yuba River below the New Colgate Powerhouse would be essentially equivalent during October, November, February, April, and June through September, would increase slightly during May, and would decrease slightly during December, January and March, under the Cumulative Condition scenario relative to the existing condition scenario.

For critically dry water year types, average monthly water temperatures in the Yuba River below the New Colgate Powerhouse would be essentially equivalent during October, November, and April through June, and would decrease somewhat during December through March, and July through September, under the Cumulative Condition scenario relative to the existing condition scenario.

For the one extreme critically dry water year (1977), average monthly water temperatures in the Yuba River below the New Colgate Powerhouse would decrease during all months of the year, but would be essentially equivalent during March and August, under the Cumulative Condition scenario relative to the existing condition scenario.

Table 7.5.3-6. Long-term average water temperature and average water temperature by water year type in the Yuba River below New Colgate Powerhouse under the Cumulative Condition, relative to the existing condition.

Analysis Period	Monthly Mean Water Temperature (ºF)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-term												
Full Simulation Period²												
Cumulative Condition	49.7	48.8	45.9	44.7	44.5	45.7	46.9	47.1	47.6	48.0	48.6	49.6
Existing Condition	49.7	49.1	46.4	44.8	44.7	45.9	46.9	46.9	47.3	47.8	48.6	49.5
Difference	0.0	-0.3	-0.5	-0.1	-0.2	-0.2	0.0	0.2	0.3	0.2	0.0	0.1
Water Year Types¹												
Wet												
Cumulative Condition	49.6	48.4	45.2	44.2	44.5	44.8	45.6	46.4	47.3	47.7	48.2	49.7
Existing Condition	49.7	48.7	45.5	44.3	44.5	44.8	45.6	46.3	46.9	47.2	48.2	49.5
Difference	-0.1	-0.3	-0.3	-0.1	0.0	0.0	0.0	0.1	0.4	0.5	0.0	0.2
Above Normal												
Cumulative Condition	51.1	50.0	46.5	44.2	44.4	45.1	46.0	46.8	47.0	47.9	48.5	49.5
Existing Condition	50.8	50.1	47.0	44.4	44.6	45.1	45.9	46.4	46.8	47.6	48.4	49.3
Difference	0.3	-0.1	-0.5	-0.2	-0.2	0.0	0.1	0.4	0.2	0.3	0.1	0.2
Below Normal												
Cumulative Condition	49.1	48.4	44.9	44.4	44.0	45.4	46.8	47.2	47.6	48.2	48.8	49.8
Existing Condition	49.2	48.7	45.2	44.1	44.1	45.6	47.2	46.9	47.3	47.9	48.8	49.7
Difference	-0.1	-0.3	-0.3	0.3	-0.1	-0.2	-0.4	0.3	0.3	0.3	0.0	0.1
Dry												
Cumulative Condition	49.1	48.4	46.5	45.3	44.4	46.8	48.5	47.8	47.9	48.0	48.5	49.1
Existing Condition	49.0	48.7	47.0	45.7	44.7	47.3	48.2	47.4	47.7	47.8	48.4	49.1
Difference	0.1	-0.3	-0.5	-0.4	-0.3	-0.5	0.3	0.4	0.2	0.2	0.1	0.0
Critically Dry												
Cumulative Condition	49.8	49.1	45.5	43.6	44.7	46.0	47.1	46.9	47.5	47.7	48.5	49.3
Existing Condition	49.8	49.4	45.9	44.0	45.2	46.4	47.1	47.2	47.6	48.1	49.0	49.8
Difference	0.0	-0.3	-0.4	-0.4	-0.5	-0.4	0.0	-0.3	-0.1	-0.4	-0.5	-0.5
Extreme Critically Dry												
Cumulative Condition	50.3	50.4	49.9	48.5	48.4	47.8	49.1	50.0	50.4	50.9	52.1	53.6
Existing Condition	51.3	51.4	50.7	49.2	48.8	48.1	49.9	50.4	50.9	51.3	52.4	54.1
Difference	-1.0	-1.0	-0.8	-0.7	-0.4	-0.3	-0.8	-0.4	-0.5	-0.4	-0.3	-0.5

[1] As defined by the "Smartsville Index" described in Exhibit E2

[2] Based on a 33-year simulation period

Under the Cumulative Condition scenario relative to the existing condition scenario, average monthly flows in the Yuba River below the New Colgate Powerhouse generally would be similar during all months for most water year types overall, but would increase substantially during several months of the one extreme critically dry water year (1977). Therefore, instream flow habitat availability would also be expected to be generally similar for all fall-run Chinook salmon and spring-run Chinook salmon lifestages during most water years, but might be improved during the summer and early fall period of extreme critically dry water years for fall-run Chinook salmon adult immigration and holding, and for spring-run Chinook salmon adult immigration and holding, spawning, embryo incubation, and juvenile rearing and downstream movement.

Simulated average monthly water temperatures in the Yuba River below the New Colgate Powerhouse are generally similar during most months of the year during all water year types, except for some slight increases during the summer months of wetter water years, slight decreases during the winter and spring months of wetter water years, and slight decreases during most months of drier water years. Because simulated average monthly water temperatures under the Cumulative Condition are always below 54°F, they never would exceed any of the fall-run or spring-run Chinook salmon upper tolerance WTI values under the Cumulative Condition scenario.

Overall, changes in simulated flows and water temperatures in the Yuba River below New Colgate Powerhouse would not be expected to substantially affect EFH in this reach, but may improve EFH conditions during extreme critically dry water year types.

7.5.4 Yuba River Downstream of Englebright Dam

The cumulative effects assessment in this EFH Assessment addresses changes in flows and water temperatures in the Yuba River downstream of Englebright Dam resulting from changes in operations of projects in the upper Yuba River Basin upstream of Englebright Dam, and increased diversions associated with implementation of the Yuba-Wheatland In-Lieu Groundwater Recharge and Storage Project (Wheatland Project).

Increased diversions associated with the Wheatland Project represent a future state or private action reasonably certain to occur. The Cumulative Condition scenario includes the irrigation demands for the Member Units listed previously plus the future irrigation demands of Wheatland Water District, which began receiving surface water through a new canal extension in 2010. For this Applicant-Prepared Draft EFH assessment, the cumulative effects assessment does not address changes in exposure of juvenile spring-run Chinook salmon and steelhead to impingement, entrainment and predation rates at the South Yuba/Brophy Diversion Canal and Facilities, because these effects will be evaluated in a future action requiring separate ESA consultation.

Modeling of projects in the upper Yuba River Basin upstream of Englebright Dam is available for the period extending from WY 1975 through 2008, and therefore cumulative effects were evaluated by comparing hydrologic and water temperature simulations for that period, under both the Cumulative Condition and the existing conditions scenarios. Otherwise, the same methodologies utilized for comparison of the Proposed Action and existing conditions scenarios were used to evaluate potential effects to managed species and their EFH in the Yuba River downstream of Englebright Dam associated with the Cumulative Condition, relative to existing conditions (also referred to as the Environmental Baseline, the term used in the Applicant-Prepared Draft BA).

In addition to these quantitative hydrologic and water temperature evaluations, an evaluation is presented here for each stressor to listed species that was identified under the existing conditions discussion. This presentation discusses whether the Cumulative Condition would affect that stressor, whether that effect would be beneficial or adverse, and the resultant magnitude of effect of each stressor. These evaluations are followed by identifications of other future non-Federal activities that are reasonably certain to occur in the Action Area, with particular reference to the Yuba River downstream of Englebright Dam. Identified activities are evaluated as to whether they have the potential to affect managed species or their EFH, including any effects related to instream flows and water temperatures.

7.5.4.1 Flow-Dependent Habitat Availability

7.5.4.1.1 Spring-run Chinook Salmon Spawning Habitat

Table 7.5.4-1 displays the long-term average and average by water year type spring-run Chinook salmon spawning WUA (percent of maximum) under the Cumulative Condition and Environmental Baseline scenarios. Over the entire 41-year simulation period, long-term average spring-run Chinook salmon spawning habitat availability (WUA) in the Yuba River downstream of Englebright Dam is similar under the Cumulative Condition relative to the Environmental Baseline (long-term average of 94.0 percent versus 94.6 percent of the maximum WUA). The Cumulative Condition would provide slightly less average amounts (-0.7 to -1.2%) of maximum spawning habitat during all water year types except critical water years, when the Cumulative Condition would provide an average of 1.0 percent more than the Environmental Baseline. As with the Environmental Baseline, the Cumulative Condition would provide, on the average, over 90 percent of maximum spawning WUA during all water year types.

Table 7.5.4-1. Long-term and water year type average spring-run Chinook salmon spawning WUA (percent of maximum) under the Cumulative Condition and Environmental Baseline scenarios.

Scenario	Long-term Full Simulation Period[2]	Water Year Types[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Cumulative Condition	94.0	91.2	93.1	95.2	94.9	97.1
Environmental Baseline	94.6	92.4	94.2	95.9	96.1	96.1
Difference	-0.5	-1.2	-1.1	-0.7	-1.2	1.0

[1] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification.
[2] Based on the WY 1975-2008 simulation period.

Habitat duration curves for spring-run Chinook salmon spawning under the Cumulative Condition and Environmental Baseline scenarios are presented in Figure 7.5.4-1. The Cumulative Condition would provide slightly lesser amounts of spawning habitat availability over much of the distribution, with about 2 percent less habitat availability over about 15 percent of the exceedance probability distribution. Also, the Cumulative Condition would achieve over 90 percent of maximum spawning WUA with about an 84 percent probability, while the Environmental Baseline scenario would achieve over 90 percent of maximum spawning WUA with about an 86 percent probability.

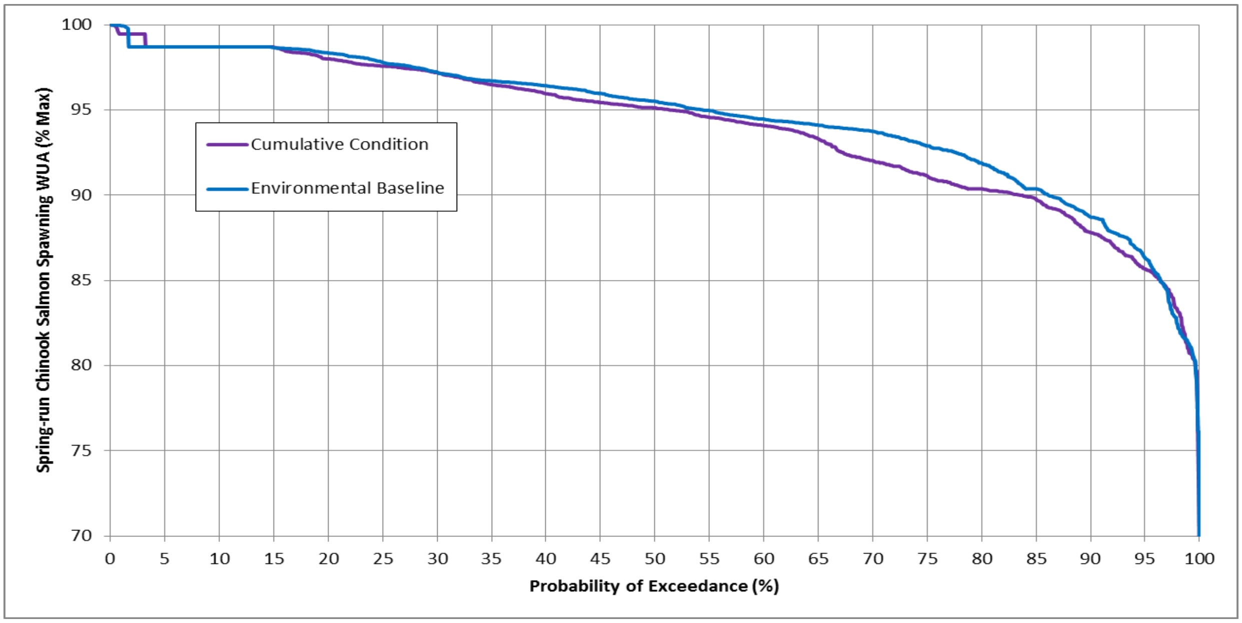

Figure 7.5.4-1. Spring-run Chinook salmon spawning habitat duration over the WY 1975 - 2008 hydrologic period for the Cumulative Condition and Environmental Baseline scenarios.

For the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), 97.9 percent of spring-run Chinook salmon maximum spawning WUA would be provided under the Cumulative Condition scenario compared to the 98.2 percent that would be provided under the Environmental Baseline scenario.

7.5.4.1.2 Fall-run Chinook Salmon Spawning Habitat

Table 7.5.4-2 displays the long-term average and average by water year type fall-run Chinook salmon spawning WUA (percent of maximum) under the Cumulative Condition and the Environmental Baseline scenarios. Over the entire 41-year simulation period, long-term average fall-run Chinook salmon spawning habitat availability (WUA) in the Yuba River downstream of Englebright Dam is similar under the Cumulative Condition relative to the Environmental Baseline (long-term average of 93.2 percent versus 93.4 percent of the maximum WUA). The Cumulative Condition provides slightly less average amounts (-0.2 to -0.4%) of maximum spawning habitat during all water year types. The Cumulative Condition and Environmental Baseline scenarios each would provide, on the average, over 90 percent of maximum spawning WUA during all water year types except above normal water years.

Habitat duration curves for fall-run Chinook salmon spawning under the Cumulative Condition and Environmental Baseline scenarios are presented in Figure 7.5.4-2. The Cumulative Condition would provide slightly lesser amounts of spawning habitat availability over about 10 percent of the exceedance probability distribution. The Cumulative Condition and Environmental Baseline each would achieve over 90 percent of maximum spawning WUA with about an 87 percent probability.

Table 7.5.4-2. Long-term and water year type average fall-run Chinook salmon spawning WUA (percent of maximum) under the Cumulative Condition scenario and Environmental Baseline scenario (existing conditions).

Scenario	Long-term Full Simulation Period[2]	Water Year Types[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Cumulative Condition	93.2	95.4	88.3	92.3	95.1	91.3
Environmental Baseline	93.4	95.5	88.7	92.5	95.4	91.5
Difference	-0.2	-0.2	-0.4	-0.2	-0.2	-0.2

[1] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

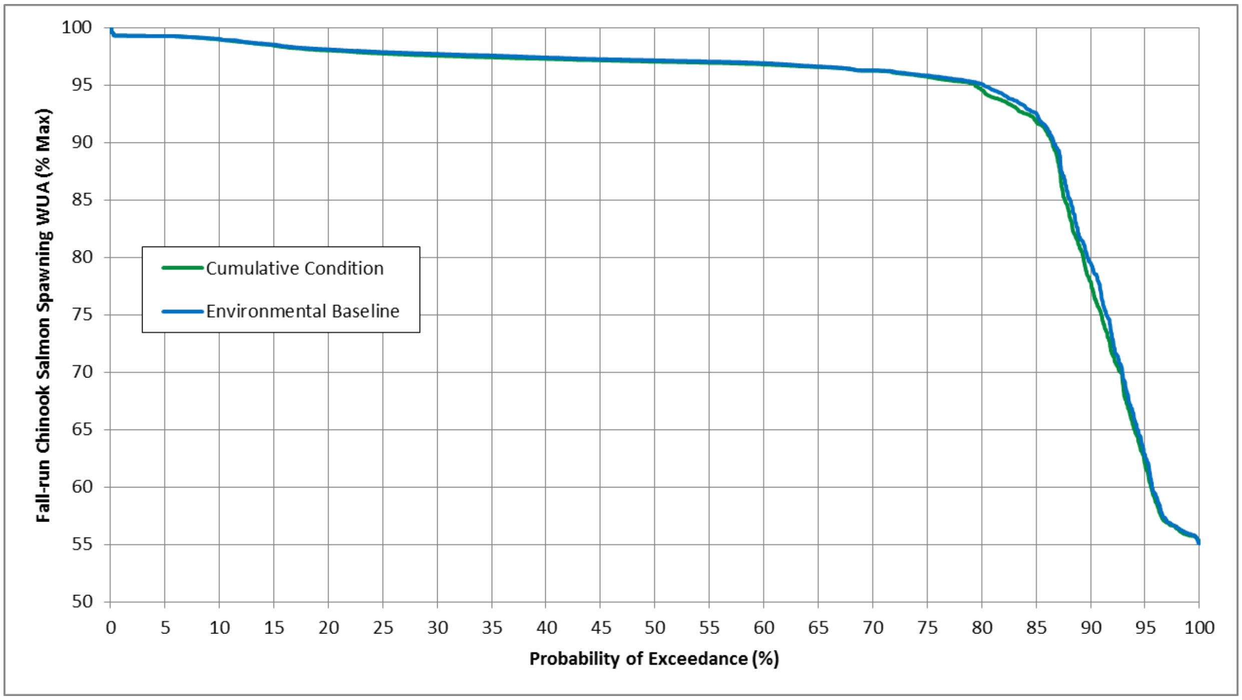

Figure 7.5.4-2. Fall-run Chinook salmon spawning habitat duration over the WY 1975 - 2008 hydrologic period for the Cumulative Condition and Environmental Baseline scenarios.

For the one conference year (WY 1977) included in the simulated period of evaluation (WY 1970-2010), 97.4 percent of fall-run Chinook salmon maximum spawning WUA would be provided under the Cumulative Condition compared to the 97.5 percent that would be provided under the Environmental Baseline (existing conditions).

Flow-dependent spawning habitat availability under the Environmental Baseline (existing conditions) would represent a low stressor to Yuba River Chinook salmon. Because of the similarity in spawning habitat availability under the Cumulative Condition relative to the Environmental Baseline, this stressor remains characterized as low under the Cumulative Condition.

Moreover, the Cumulative Condition would provide substantially more spring-run and fall-run Chinook salmon spawning habitat than the Without-Project scenario would provide. As previously described, the Without-Project scenario would achieve over 90 percent of maximum spawning WUA with only about a 60 percent probability for spring-run Chinook salmon, and with only about a 44 percent probability for fall-run Chinook salmon.

7.5.4.2 Flow Fluctuations and Redd Dewatering

As discussed in the Applicant-Prepared Draft BA, under both the Cumulative Condition and the Environmental Baseline scenarios, the potential for spring-run Chinook salmon redd dewatering would be very low. Flow-dependent redd dewatering therefore represents a low stressor to Yuba River spring-run Chinook salmon under the Cumulative Condition.

As previously described, it is reasonable to surmise that the magnitude of redd dewatering for fall-run Chinook salmon would be intermediate, compared to the magnitude of redd dewatering for spring-run Chinook salmon and steelhead, due to intermediate exposure to uncontrolled flow conditions during the fall-run Chinook salmon spawning period. Hence, for purposes of this Applicant-Prepared Draft EFH Assessment, it is assumed that redd dewatering represents a low/medium stressor to fall-run Chinook salmon under the Cumulative Condition.

7.5.4.3 Fry and Juvenile Stranding

Project operations maintain relatively stable Yuba River flows downstream of Englebright Dam through the fall, which provide stable spawning flows for spring-run and fall-run Chinook salmon and protect redds from dewatering, and which also minimize stranding of Chinook salmon fry, which begin to emerge from redds in November. Thereafter, lower Yuba River flows during the winter and spring are often uncontrolled, and stranding of Chinook salmon fry and juveniles can occur naturally during periods of uncontrolled runoff and spills, either through uncontrolled flow fluctuations or as runoff subsides and flows drop to controllable levels. Under existing conditions, fry and juvenile stranding represents a stressor of low to medium magnitude to Chinook salmon. Because the Cumulative Condition would not affect the magnitude of this stressor, the potential “exposure” of Chinook salmon to this stressor, and the effects of this stressor on Chinook salmon EFH, this stressor remains a low to medium stressor to Chinook salmon in the Yuba River downstream of Englebright Dam.

7.5.4.4 Water Temperature

7.5.4.4.1 Cumulative Condition Water Temperatures

Spring-run Chinook Salmon

<u>Adult Immigration</u>
For the April through September adult immigration lifestage period, the water temperature index value of 68°F would not be exceeded with a 10 percent or greater probability at any of the three evaluated locations under the Cumulative Condition scenario (Table 7.5.4-3).

Adult Holding

For the April through September adult holding lifestage period, the water temperature index value of 65°F would not be exceeded with a 10 percent or greater probability at Smartsville or Daguerre Point Dam, but would be exceeded with a 10 percent or greater probability at Marysville from mid-June through mid-September under the Cumulative Condition scenario.

Spawning

For the September through mid-October spawning lifestage period, the water temperature index value of 58°F would not be exceeded at the Smartsville location with a 10 percent or greater probability under the Cumulative Condition scenario, the only location used to evaluate this lifestage.

Embryo Incubation

For the September through December embryo incubation lifestage period, the water temperature index value of 58°F would not be exceeded at the Smartsville location with a 10 percent or greater probability under the Cumulative Condition scenario.

Table 7.5.4-3. Cumulative Condition modeled water temperature exceedances[30] for spring-run Chinook salmon lifestage- and location-specific periodicities in the Yuba River at Smartsville (SMRT), below Daguerre Point Dam (DPD), and Marysville (MRY).

Spring-run Chinook Salmon Lifestage	Node	Upper Tolerance WTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration	SMRT	68°F							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
	Below DPD	68°F							0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.1	1.6	2.8	1.4	0.0						
	MRY	68°F							0.0	0.0	0.0	0.4	2.6	3.2	3.6	4.5	3.4	4.0	3.0	3.0						
Adult Holding	SMRT	65°F							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
	Below DPD	65°F							0.0	0.0	0.0	0.0	0.0	2.0	3.0	3.0	3.0	3.0	3.0	2.8						
	MRY	65°F							0.0	0.2	0.2	3.6	9.9	13.3	25.5	33.1	23.2	21.4	14.5	7.1						
Spawning	SMRT	58°F																	3.0	3.0	3.0					
Embryo Incubation	SMRT	58°F																	3.0	3.0	3.0	3.0	1.0	0.0	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	3.0	3.0	3.0	3.0	3.0	2.8	0.8	0.0	0.0	0.0	0.0	0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	3.6	9.9	13.3	25.5	33.1	23.2	21.4	14.5	7.1	4.0	0.8	0.0	0.0	0.0	0.0
Yearling+ Smolt Emigration	Below DPD	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										0.0	0.0	0.0	0.0	0.0	0.0
	MRY	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										1.0	0.0	0.0	0.0	0.0	0.0

Juvenile Rearing and Downstream Movement

For the year-round juvenile rearing and downstream movement lifestage period, the water temperature index value of 65°F would not be exceeded with a 10 percent or greater probability during any month of the year at the Daguerre Point Dam location, but would be exceeded with a

[30] Percent probability of mean daily temperature exceeding specified water temperature index values as estimated by the Project Daily Water Temperature Model.

13-33 percent probability from the last half of June through the first half of September at the Marysville location under the Cumulative Condition scenario.

Yearling+ Smolt Emigration

For the October through mid-May yearling+ smolt emigration lifestage period, the water temperature index value of 68°F generally would not be exceeded at either the Daguerre Point Dam or Marysville locations under the Cumulative Condition scenario.

Fall-run Chinook Salmon

Adult Immigration and Staging

For the July through December adult immigration and staging lifestage period, the water temperature index value of 68°F would not be exceeded with a 10 percent or greater probability at either Daguerre Point Dam or Marysville under the Cumulative Condition scenario (Table 7.5.4-4).

Spawning

For the October through December spawning lifestage period, the water temperature index value of 58°F would not be exceeded at the Smartsville location with a 10 percent or greater probability during any month, but would be exceeded at Daguerre Point Dam during October, under the Cumulative Condition scenario. However, fall-run Chinook salmon are primarily observed spawning during October in the upper reaches (upstream of Daguerre Point Dam) of the lower Yuba River (that is the reaches between Englebright and Daguerre Point dams). Spawning fall-run Chinook salmon begin expanding their spatial distribution further downstream in later fall months as suitable temperatures become available near or downstream of Daguerre Point Dam (RMT 2013).

Embryo Incubation

For the October through March embryo incubation lifestage period, the water temperature index value of 58°F would not be exceeded at the Smartsville location with a 10 percent or greater probability during any month evaluated, but would be exceeded at Daguerre Point Dam during October, under the Cumulative Condition scenario. However, because fall-run Chinook salmon spawning during October generally occurs upstream of Daguerre Point Dam, embryo incubation during October also generally would occur upstream of Daguerre Point Dam.

Juvenile Rearing and Downstream Movement

For the late December through June juvenile rearing and downstream movement lifestage period, the water temperature index value of 65°F would not be exceeded with a 10 percent or greater probability during any month of the year at the Daguerre Point Dam location, but would be exceeded with a 13 percent probability during late June at the Marysville location under the Cumulative Condition scenario relative to the existing conditions scenario.

Table 7.5.4-4. Cumulative Condition modeled water temperature exceedances[31] for fall-run Chinook salmon lifestage- and location-specific periodicities in the Yuba River at Smartsville, below Daguerre Point Dam, and Marysville.

Fall-run Chinook Salmon Lifestage	Node	Upper Tolerance WTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration and Staging	Below DPD	68°F													0.2	1.1	1.6	2.8	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MRY	68°F													3.6	4.5	3.4	4.0	3.0	3.0	1.0	0.0	0.0	0.0	0.0	0.0
Spawning	SMRT	58°F																			3.0	3.0	1.0	0.0	0.0	0.0
	Below DPD	58°F																			61.8	16.7	2.2	0.0	0.0	0.0
Embryo Incubation	SMRT	58°F	0.0	0.0	0.0	0.0	0.0	0.0													3.0	3.0	1.0	0.0	0.0	0.0
	Below DPD	58°F	0.0	0.0	0.0	0.0	0.0	0.0													61.8	16.7	2.2	0.0	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0												0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	3.6	9.9	13.3												0.0

7.5.4.4.2 Cumulative Condition Compared to the Environmental Baseline

Spring-run Chinook Salmon

Table 7.5.4-5 displays the differences in spring-run Chinook salmon lifestage-specific water temperature index value exceedance probabilities under the Cumulative Condition scenario relative to the Environmental Baseline scenario (i.e., the probability of exceeding a water temperature index value under the Cumulative Condition scenario minus the probability of exceeding that water temperature index value under the Environmental Baseline scenario).

Water temperature exceedance probabilities are generally similar under the Cumulative Condition and Environmental Baseline scenarios during the fall through spring months (i.e., October through May) for all lifestages of spring-run Chinook salmon. Some differences in simulated water temperatures would occur during the spring-run Chinook salmon adult holding, and juvenile rearing and downstream movement lifestages. For all months of the year, no lifestage-specific water temperature index values would be exceeded more often with a 10 percent or greater probability at any of the three evaluated locations under the Cumulative Condition, relative to the Environmental Baseline.

For the adult holding period, which extends from June through September, water temperatures at the Marysville Gage would be somewhat higher under the Cumulative Condition scenario compared to the Environmental Baseline scenario. However, as previously discussed, adult spring-run Chinook salmon do not spend extended periods of time at downstream locations (e.g., Marysville), and they primarily exhibit holding behavior just downstream of, or above, Daguerre Point Dam.

[31] Percent probability of mean daily temperature exceeding specified water temperature index values as estimated by the Project Daily Water Temperature Model.

Table 7.5.4-5. Difference in simulated water temperature exceedance probabilities for spring-run Chinook salmon lifestages under the Cumulative Condition relative to the Environmental Baseline.

Spring-run Chinook Salmon Lifestage	Node	Upper Tolerance WTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration	SMRT	68°F							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
	Below DPD	68°F							0.0	0.0	0.0	0.0	0.0	0.0	-1.8	-1.9	-1.4	-0.2	-1.6	-2.8						
	MRY	68°F							0.0	0.0	0.0	0.0	0.2	0.0	0.2	1.3	0.4	0.6	0.0	0.0						
Adult Holding	SMRT	65°F							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
	Below DPD	65°F							0.0	0.0	0.0	0.0	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	-0.2						
	MRY	65°F							-0.2	0.0	-0.2	0.6	1.6	1.6	4.8	9.8	6.7	4.7	6.7	2.8						
Spawning	SMRT	58°F																	0.0	0.0	0.0					
Embryo Incubation	SMRT	58°F																	0.0	0.0	0.0	1.7	1.0	0.0	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	-0.2	0.6	1.6	1.6	4.8	9.8	6.7	4.7	6.7	2.8	1.2	0.8	0.0	0.0	0.0	0.0
Yearling+ Smolt Emigration	Below DPD	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										0.0	0.0	0.0	0.0	0.0	0.0
	MRY	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										0.0	0.0	0.0	0.0	0.0	0.0

For the juvenile rearing and downstream movement lifestage, which extends year-round, water temperatures at the Marysville Gage would be somewhat higher under the Cumulative Condition scenario compared to the Environmental Baseline scenario. Also, exposure of downstream migrating juveniles during summer months to water temperatures at Marysville would not be expected to substantially occur due to minimal outmigration during the summer, and the suitability of rearing temperatures further upstream in this reach below Daguerre Point Dam.

For the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), water temperatures at Smartsville under the Cumulative Condition scenario are generally similar (less than 1% difference) to those under the Environmental Baseline scenario. At Daguerre Point Dam, average one-half month water temperatures would be cooler under the Cumulative Condition scenario relative to the Environmental Baseline scenario for the period extending from late January through September. Conference year water temperatures at Daguerre Point Dam under the Cumulative Condition scenario relative to the Environmental Baseline scenario would be slightly cooler (less than 1% difference) for late January through June, and would be increasingly cooler through September (nearly 5°F or 7%). This same pattern is observed at Marysville, although the magnitude of difference is greater, with temperatures under the Cumulative Condition scenario ranging from about 8 to 11°F (9 to 13.3%) cooler than those under the Environmental Baseline scenario. These cooler water temperatures under the Cumulative Condition would represent more suitable water temperatures during the summer, which includes portions of the spring-run Chinook salmon adult immigration and holding, and juvenile rearing and downstream movement lifestages.

Fall-run Chinook Salmon

Table 7.5.4-6 displays the differences in fall-run Chinook salmon lifestage-specific water temperature index value exceedance probabilities under the Cumulative Condition scenario relative to the Environmental Baseline scenario (i.e., the probability of exceeding a water temperature index value under the Cumulative Condition scenario minus the probability of exceeding that water temperature index value under the Environmental Baseline scenario).

Table 7.5.4-6. Difference in simulated water temperature exceedance probabilities for fall-run Chinook salmon lifestages under the Cumulative Condition relative to the Environmental Baseline.

Fall-run Chinook Salmon Lifestage	Node	Upper Tolerance WTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration and Staging	Below DPD	68°F													-1.8	-1.9	-1.4	-0.2	-1.6	-2.8	0.0	0.0	0.0	0.0	0.0	0.0
	MRY	68°F													0.2	1.3	0.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spawning	SMRT	58°F																			0.0	1.7	1.0	0.0	0.0	0.0
	Below DPD	58°F																			23.2	6.3	1.6	0.0	0.0	0.0
Embryo Incubation	SMRT	58°F	0.0	0.0	0.0	0.0	0.0	0.0													0.0	1.7	1.0	0.0	0.0	0.0
	Below DPD	58°F	0.0	0.0	0.0	0.0	0.0	0.0													23.2	6.3	1.6	0.0	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.4	0.0												0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	-0.2	0.6	1.6	1.6												0.0

Water temperature exceedance probabilities generally would be similar under the Cumulative Condition and Environmental Baseline scenario during all periods evaluated for all lifestages of fall-run Chinook salmon, with the exception of early October, when water temperatures would increase more often by 10 percent or more under the Cumulative Condition scenario relative to the Environmental Baseline (existing conditions) scenario. However, as previously discussed, fall-run Chinook salmon are primarily observed spawning during October in the upper reaches in the Yuba River upstream of Daguerre Point Dam. Spawning fall-run Chinook salmon begin expanding their spatial distribution further downstream in later fall months as suitable temperatures become available near or downstream of Daguerre Point Dam (RMT 2013). Therefore, it is not expected that fall-run Chinook salmon spawning and embryo incubation would be adversely affected under the Cumulative Condition.

For the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), water temperatures at Smartsville under the Cumulative Condition scenario would be generally similar (less than 1% difference) to those under the Environmental Baseline scenario. At Daguerre Point Dam, average one-half month water temperatures would be cooler under the Cumulative Condition scenario relative to the Environmental Baseline scenario for the period extending from late January through September. Conference year water temperatures at Daguerre Point Dam under the Cumulative Condition scenario relative to the Environmental Baseline scenario would become increasingly cooler through September (nearly 5°F or 7%). This same pattern is observed at Marysville, although the magnitude of difference is greater, with temperatures under the Cumulative Condition scenario ranging from about 8 to 11°F (9 to 13.3%) cooler than the Environmental Baseline scenario. These cooler water temperatures under the Cumulative Condition would represent more suitable water temperatures during the fall-run Chinook salmon adult immigration and staging lifestage.

Under the Environmental Baseline (existing conditions), water temperatures represent a low stressor to Yuba River Chinook salmon. Although relatively minor increases in simulated water temperatures with relatively low probabilities of occurrence are estimated to occur under the Cumulative Condition relative to the Environmental Baseline, this stressor remains characterized as low under the Cumulative Condition.

7.5.4.5 Narrows 2 Operations and Fish Movement

The Cumulative Condition does not include any changes to Narrows 2 operations, with the exception of changes in instream flow requirements during Conference Years. At this time, Narrows 2 operations can be characterized as representing a low stressor to Chinook salmon. However, additional information regarding Narrows 2 operations as a stressor will be available when additional specific studies are completed during 2014.

7.5.4.6 Passage Impediments/Barriers

7.5.4.6.1 Englebright Dam

The existence of Englebright Dam represents a very high stressor to Yuba River spring-run Chinook salmon under the Environmental Baseline (existing conditions). Because the Cumulative Condition would not affect the magnitude of this stressor, the potential "exposure" of Chinook salmon to this stressor, or the effects of this stressor on its EFH, it would remain a very high stressor to Chinook salmon in the Yuba River under the Cumulative Condition.

Daguerre Point Dam

Because the Cumulative Condition will not affect the potential "exposure" of Chinook salmon to this stressor, the magnitude of this stressor, and the effects of this stressor on Chinook salmon EFH, this stressor would remain a medium to high stressor to Chinook salmon in the Yuba River downstream of Englebright Dam.

7.5.4.7 Predation

Because the Cumulative Condition would not affect the potential "exposure" of Chinook salmon to this stressor or the magnitude of this stressor, it would remain a high stressor to Chinook salmon in the Yuba River.

7.5.4.8 Physical Habitat Alteration

7.5.4.8.1 Natural River Morphology and Function

Because the Cumulative Condition would not affect the potential “exposure” of Chinook salmon to this stressor, the magnitude of this stressor, or the effects of this stressor on Chinook salmon EFH, this stressor would remain a relatively high stressor to Chinook salmon in the Yuba River.

7.5.4.8.2 Floodplain Habitat Availability

Because the Cumulative Condition would not affect the potential “exposure” of Chinook salmon to this stressor, the magnitude of this stressor, or the effects of this stressor on Chinook salmon EFH, this stressor would remain a medium stressor to Chinook salmon in the Yuba River.

7.5.4.8.3 Riparian Habitat and Instream Cover (Riparian Vegetation, Instream Woody Material)

Because the Cumulative Condition would not affect the potential “exposure” of Chinook salmon to this stressor, the magnitude of this stressor, or the effects of this stressor on its EFH, it would remain a high stressor to Chinook salmon in the Yuba River downstream of Englebright Dam.

SECTION 8.0
SUMMARY OF EFFECTS

8.1 Summary of Anticipated Effects of the Proposed Action on EFH in the Action Area

8.1.1 Yuba River Watershed Upstream of Englebright Dam

YCWA's Project will continue to capture sediment, reduce peak lows and augment low flows during the summer, and these flows have the potential to affect unoccupied EFH downstream of Project facilities in the Yuba River Watershed upstream of Englebright Dam. These effects are considered to be largely beneficial, with some minor effects. Changes in flows from spills at the Our House and Log Cabin diversion dams and at New Bullards Bar Dam will continue to occur, but they will occur less frequently at Our House Diversion Dam and New Bullards Bar Dam because of implementation of spill cessation measures.

Project-related effects on benthic macroinvertebrate communities would be potentially positive, but minor. YCWA's studies did not identify any relationship between releases from Project facilities and benthic macroinvertebrate metrics.

For all temporary construction activities related to all proposed measures, potential effects to aquatic habitat (i.e., EFH) have been evaluated and addressed in the DLA (see Section 3.0 of Exhibit E). Construction-related effects would be temporary, and would not be expected to result in long-term adverse effects to EFH in the Action Area.

Overall, the Proposed Action is expected to result in similar or better rainbow trout habitat than occurs under existing conditions. Consequently, it is reasonable to assume that if aquatic conditions would improve for rainbow trout, then conditions also would improve for unoccupied EFH in the Yuba River Watershed upstream of Englebright Dam.

NMFS (2004a) states that, as part of an EFH Assessment, Federal action agencies should indicate whether a proposed action may adversely affect HAPCs. As previously discussed, NMFS and PFMC (2011) developed five potential HAPCs for Pacific Coast. The three HAPCs that occur within the Action Area for this Applicant-Prepared Draft EFH Assessment are: (1) spawning habitat; (2) thermal refugia; and (3) complex channels and floodplain habitats. Based on the flow and water temperature-related evaluations described in this Applicant-Prepared Draft EFH Assessment, the Proposed Action would not adversely affect potential spawning habitat, thermal refugia, or complex channels and floodplain habitats in the Yuba River watershed upstream of Englebright Dam.

8.1.2 Yuba River Downstream of Englebright Dam

Under the Proposed Action, YCWA's Project will continue to operate to implement the Yuba Accord flow schedules, except for Conference Year requirements. The changes in Conference

Year requirements under the Proposed Action would provide similar or more suitable habitat conditions, including EFH, for Chinook salmon, relative to the existing conditions for Conference Years.

The simulated increases in water temperatures downstream of Daguerre Point Dam during early October of the fall-run Chinook salmon spawning and embryo incubation period under the Proposed Action (and the Cumulative Condition) scenarios would result from changes in Project operations upstream of Englebright Dam associated with the Proposed Action that were developed to improve habitat for rainbow trout. However, based on Chinook salmon redd surveys and analyses conducted by RMT (2013), during October fall-run Chinook salmon spawn upstream of Daguerre Point Dam (where simulated water temperature conditions would be suitable), and gradually begin to spawn downstream of Daguerre Point Dam as water temperatures become suitable under existing conditions. Therefore, the increase in water temperatures during October downstream of Daguerre Point Dam under these scenarios would not adversely affect Chinook salmon or its EFH in the Yuba River downstream of Englebright Dam.

Overall, the Proposed Action would not eliminate, diminish, or disrupt EFH in the Yuba River downstream of Englebright Dam. The Proposed Action would not affect the potential exposure of Chinook salmon to stressors in the Yuba River downstream of Englebright Dam under existing conditions, nor would the Proposed Action change the magnitude of existing stressors evaluated in this Applicant-Prepared Draft EFH Assessment. Although climate change was identified as a new threat during the 2011 5-Year review (NMFS and PFMC 2011), effects on EFH that may result from climate change would not be attributable to the Proposed Action. The Proposed Action would continue to provide dependable cool water temperatures (thermal refugia) in a majority of water years in the hottest summer and early fall months, which would minimize exposure of Chinook salmon to this stressor throughout the Yuba River downstream of Englebright Dam. Nevertheless, it is recognized that climate change will continue to be a stressor to EFH for Chinook salmon.

Of the other 21 threats to Pacific salmon EFH identified in Amendment 14 of the FMP, the Proposed Action could potentially affect EFH through changes in flows and water temperatures in the Yuba River downstream of Englebright Dam. However, flow and water temperature-related effects on EFH downstream of Englebright Dam associated with the Proposed Action are expected to result in non-substantive effects, or beneficial effects. The Proposed Action also would not adversely affect EFH conditions in the Feather River downstream of the Yuba River, the Sacramento River downstream of the Feather River, or in the Delta.

NMFS (2004a) states that, as part of an EFH Assessment, Federal action agencies should indicate whether a proposed action may adversely affect HAPCs. Considering the flow and water temperature-related evaluations described in this Applicant-Prepared Draft EFH Assessment, the Proposed Action would not adversely affect spawning habitat, thermal refugia, or complex channels and floodplain habitats in the Yuba River downstream of Englebright Dam. The Proposed Action also would not adversely affect HAPCs in the Feather River downstream of the Yuba River, the Sacramento River downstream of the Feather River, or in the Delta.

8.2 Summary of Anticipated Effects of the Cumulative Condition on EFH in the Action Area

8.2.1 Yuba River Watershed Upstream of Englebright Dam

Potential effects to unoccupied EFH in the Action Area in the Yuba River watershed upstream of Englebright Dam would be similar to those discussed above for the Proposed Action, and therefore, would not be expected to adversely affect Chinook salmon EFH.

8.2.2 Yuba River Downstream of Englebright Dam

Potential effects to EFH in the Action Area in the Yuba River downstream of Englebright Dam would be similar to those discussed above for the Proposed Action, and therefore, would not be expected to adversely affect Chinook salmon EFH.

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SECTION 9.0

DETERMINATION

This Applicant-Prepared Draft EFH assessment describes the relationship between the relicensing of the Project and Chinook salmon EFH in the vicinity of the Project, and evaluates the potential effect of the Proposed Action (i.e., FERC's issuance of a new license for the Project) on Chinook salmon and their designated EFH.

Overall, considering the analyses presented in this Applicant-Prepared Draft EFH Assessment, the Proposed Action will not adversely affect EFH, including potential HAPCs in the Action Area, or their management, in a manner that would: (1) reduce the quality or quantity of EFH; or (2) eliminate, diminish or disrupt the current utilization of these habitats by various lifestages of Chinook salmon. Therefore, it is concluded that the overall effects of the Proposed Action will not adversely affect designated Chinook salmon EFH in the Action Area.

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SECTION 10.0
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Applicant-Prepared Draft
Essential Fish Habitat Assessment

Attachment A

YCWA's Proposed Conditions

Yuba River Development Project
FERC Project No. 2246

Draft - December 2013

ATTACHMENT A

YCWA'S PROPOSED CONDITIONS

1.0 General

1.1 YCWA's Proposed Condition GEN1: Consult with the Forest Service Annually Regarding Project Effects on NFS Land[1]

Licensee shall, beginning in the first full calendar year of the new license term, consult with the Forest Service each year by April 15. The date, location and agenda for the meeting shall be mutually agreed to by Licensee and the Forest Service. The goals of the meetings will be to share information, mutually agree upon Project planned maintenance activities on NFS land, identify concerns that the Forest Service may have regarding the Project planned maintenance activities and their potential effects on sensitive resources on NFS land, and discuss any measures required to avoid or mitigate potential effects of the Project planned maintenance activities to resources on NFS land. Additional goals of the meeting will be to review and discuss the results of implementing license conditions and other issues related to preserving and protecting resources affected by the Project on NFS land.

At least 30 days in advance of each meeting, Licensee shall make available to the Forest Service the following material:

- List of known Project maintenance activities on NFS land planned for the calendar year, including road, trail and recreation facilities maintenance.
- Status of implementing license conditions which apply to NFS land in the previous calendar year, and planned for the current calendar year.
- Description of non-compliance events with the license in the previous calendar year.
- Reports from previous calendar year that may be required by implementation plans included in the license.
- Records (i.e., mean daily flows) from gages to document compliance with streamflow requirements in the license for the previous water year.
- Disclosure of any new special-status species populations on NFS land that may have been discovered in the previous calendar year.
- Disclosure of any new historic properties on NFS land that may have been discovered in the previous calendar year. All historic properties information discussed at the meeting

[1] This condition is similar, but not identical, to Forest Service's "Standard" Administrative Condition 1, *Consultation*, based on FPA Section final 4(e) conditions recently filed by the Forest Service with FERC on hydro relicensings in the Yuba River upstream of the Project.

will be treated as Privileged commensurate with the confidential nature of the information.

- Report (e.g., type, quantity and location on any Forest Service-approved use of pesticides on NFS land in the previous calendar year, and requested use in the current calendar year.

The agenda for each meeting will include, at a minimum, each of the items above as well as:

- Any Licensee-planned changes to Project facilities or features on or affecting NFS land.
- Revisions to implementation plans in the license.
- Review of special-status species lists (see Licensee's proposed Condition GEN2) to determine if species have been added to lists and warrant investigation.
- Discussion of needed protection measures for newly discovered special-status species populations and cultural resources.
- Need for additional Licensee and Forest Service meetings in the current calendar year.

A record of each meeting shall be kept by Licensee and shall include any recommendations made by the Forest Service for the protection of NFS land and resources. Licensee shall file the meeting record with FERC no later than 60 days following the meeting.

1.2 YCWA's Proposed Condition GEN2: Consult with the Forest Service Regarding New Ground Disturbing Activities on NFS Land[2,3]

If Licensee proposes a ground disturbing, Project-related activity on NFS land that was not addressed in the Commission's NEPA processes, then prior to filing the necessary documentation with FERC for FERC's approval, Licensee in consultation with the Forest Service, shall determine the potential Project-related effects on NFS land and whether additional information is required to proceed with the planned ground disturbing activity. Upon Forest Service's request, Licensee shall enter into an agreement with the Forest Service under which Licensee shall fund a reasonable portion of Forest Service's staff time and expenses for staff activities related to the proposed ground disturbing activity.

1.3 YCWA's Proposed Condition GEN3: Consult with the Forest Service Regarding New Facilities on NFS Land[4]

Before taking actions to construct new Project features on NFS land that may affect Forest Service special-status species (i.e. Forest Service sensitive and/or management indicator species)

[2] This condition is similar, but not identical, to Forest Service's "Standard" Administrative Condition 17, *Ground Disturbing Activities*, based on FPA Section final 4(e) conditions recently filed by the Forest Service with FERC on hydro relicensings in the Yuba River upstream of the Project.
[3] This condition overlaps in part with Article 3 in FERC's Form-L5 Standard Articles.

or their critical habitat on NFS land, Licensee shall prepare and submit a biological evaluation (BE) to the Forest Service for its review and approval. The BE shall evaluate the potential impact of the action on the species or its habitat. In coordination with the Commission, the Forest Service may require mitigation measures for the protection of the affected species or their critical habitats.

The biological evaluation shall:

- Include procedures to minimize adverse effects to special-status species.
- Ensure Project-related activities shall meet restrictions included in site management plans for special-status species.
- Develop implementation and effectiveness monitoring of measures taken or employed to reduce effects to special-status species.

Licensee shall file the BE with the Commission at least 30 days in advance of any ground disturbing activities related to the new features.

1.4 YCWA's Proposed Condition GEN4: Consult with Forest Service and USACE Regarding Use of Pesticides on Federal Land[5]

Licensee shall not use pesticides on NFS land or USACE land, or in areas affecting NFS land or USACE land to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, non-native fish, etc., without the prior written approval of the Forest Service or USACE, as appropriate.

If Licensee proposes to use pesticides on NFS land, during the Annual Meeting described in Licensee's proposed Condition GEN1, Licensee shall submit to the Forest Service a request for approval of planned uses of pesticides on NFS for the upcoming year. Licensee shall provide at a minimum the following information for the Forest Service's review:

- Whether pesticide applications are essential for use on NFS lands;
- Specific locations of use;
- Specific herbicides proposed for use;
- Application rates;
- Dose and exposure rates; and
- Safety risk and timeframes for application.

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[4] This condition overlaps in part with Article 3 in FERC's Form-L5 Standard Articles.
[5] This condition is similar, but not identical, to Forest Service's "Standard" Administrative Condition 22, *Pesticide-Use Restrictions on National Forest System Lands*, based on FPA Section final 4(e) conditions recently filed by the Forest Service with FERC on hydro relicensings in the Yuba River upstream of the Project.

Exceptions to this schedule may be allowed only when unexpected outbreaks of pests require control measures that were not anticipated at the time the report was submitted. In such an instance, an emergency request and approval may be made.

Any pesticide use that is deemed necessary to use on NFS land or USACE land within 500 feet of known locations of western pond turtles, foothill yellow-legged frog, sensitive species or culturally significant plant populations will be designed to avoid adverse effects on individuals or their habitats. Application of pesticides, if approved on NFS land, shall be consistent with Forest Service riparian conservation objectives.

On NFS land and USACE land, Licensee shall only use those pesticides registered by the U.S. Environmental Protection Agency and consistent with those applied by Forest Service or USACE, as appropriate, and approved through Forest Service or USACE, as appropriate, review for the specific purpose planned. Licensee shall strictly follow label instructions in the preparation and application of pesticides and disposal of excess materials and containers.
Licensee may also submit to the Forest Service a Pesticide Use Proposal(s) with accompanying risk assessment and other Forest Service required documents to use pesticides on NFS land on a regular basis for the term of the license as addressed further in Licensee's proposed Condition TR1. Submission of this plan will not relieve Licensee of the responsibility of annual notification and review. Licensee shall file the Pesticide Use Proposal with FERC within 30 days of Forest Service's approval of the plan.

1.5 YCWA's Proposed Condition GEN5: Review Special-Status Species Lists and Assess Newly-listed Species Annually

Licensee shall, beginning the first year of the new license term, annually review the current lists of special-status species (i.e., species that are listed under the Endangered Species Act as endangered or threatened, listed by the Forest Service as Sensitive, listed by the Plumas or Tahoe national forests as Watchlist species, or listed by State of California as endangered, threatened, fully protected or species of special concern) that might be directly affected by Project operations. The goal of the exercise is to determine if a species that is likely to be directly affected by the Project has been added to one or more of the lists since the last review of the lists.

For such newly added species, Licensee shall develop, in consultation with the agency or agencies with jurisdiction over the species, a study plan to assess the effects of the Project on the species and its habitat potentially directly affected by the Project. The plan shall include that within a reasonable time after the study is completed, Licensee shall prepare a draft report including objectives, methods, results, recommended resource measures where appropriate, and a schedule of implementation, and shall provide the draft of the final report to agencies with jurisdiction over the species for review, and that Licensee shall file the report, including evidence of consultation, with the Commission. License shall file the study plan, with evidence of consultation, with the Commission within 30 days of finalizing the study plan, and shall implement the study plan as required by the Commission.

1.6 YCWA's Proposed Condition GEN6: Provide Environmental Training to Employees

Licensee shall, beginning in the first year of the new license term, annually perform employee environmental awareness training, and shall also perform such training when a staff member is first assigned to the Project. The goal of the training shall be to familiarize Licensee's operations and maintenance staff with special-status species, non-native invasive species, and sensitive areas (e.g., special-status plant populations, non-native invasive plants populations, protected areas and historic property sites) that are known to occur within or adjacent to the FERC Project Boundary. It is not the intent of this condition that Licensee's operations and maintenance staff perform surveys or become specialists in the identification of special-status species, non-native invasive plants or historic properties. Licensee shall direct its staff to avoid disturbance to sensitive areas, and to advise all Licensee contractors to avoid sensitive areas. If Licensee determines that disturbance of a sensitive area is unavoidable, License shall consult with the appropriate agencies to minimize adverse effects to the sensitive area.

1.7 YCWA's Proposed Condition GEN7: Develop and Implement a Coordinated Operations Plan for Yuba River Development Project and Narrows Project[6, 7]

Licensee shall, within the first 90 days of the new license term, file with the Commission for approval a Coordinated Operations Plan (Plan) for the Yuba River Development Project and Narrows Project (FERC Project No. 1403). Licensee shall develop the Plan in consultation with the licensee for the Narrows Project. The purpose of the Plan shall be to provide for coordinated operations of the Yuba River Development Project and the Narrows Project to assure implementation of the flow–related conditions in the two project licenses, including maintenance of minimum streamflows during scheduled outages. Licensee shall file the Plan with the Commission, and Licensee shall implement those portions of the Plan approved by the Commission that apply to Licensee. If Licensee and the licensee for the Narrows Project are unable to reach agreement on the Plan within the first 90 days of the new license term, then Licensee shall advise the Commission of the consultations that have occurred, and shall request that the Commission issue an appropriate order for coordinated operations to Licensee and the licensee for the Narrows Project.

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[6] YCWA has not included the Coordinated Operations Plan in YCWA's Application for New License because YCWA and PG&E, the licensee for the Narrows Project, cannot negotiate the terms of the plan until such time as each party understands the conditions of the new Yuba River Development Project license, which conditions will not be known until FERC issues the new license.

[7] Article 411 in the existing the existing FERC license for PG&E's Narrows Project (FERC Project No. 1403) states: "*The Licensee* [PG&E] *shall, for the limited purpose of coordinating operations with Project 2266 for the development of fish resources in the Yuba River downstream of Englebright dam, comply with such reasonable modifications of project operations, as may be ordered by the Commission upon the relicensing or amendment of the license for FERC Project No. 2246, after notice and opportunity for hearing.*" The existing FERC license for PG&E's Narrows Project expires in 2026.

1.8 YCWA's Proposed Condition GEN8: Right to Use Englebright Dam and Reservoir[8]

Licensee may make use of Englebright Dam and Reservoir for Project purposes so long as Licensee's use does not interfere with the primary use of the reservoir for debris control.

2.0 Geology and Soils

2.1 YCWA's Proposed Condition GS1: Implement Erosion and Sediment Control Plan[9, 10]

Licensee shall implement the Erosion and Sediment Control Plan included in Licensee's application for new license, as approved by the Commission.

2.2 YCWA's Proposed Condition GS2: Implement Our House and Log Cabin Diversion Dams Sediment Excavation Plan[11, 12]

Licensee shall implement the Our House and Log Cabin Diversion Dams Sediment Excavation Plan included in Licensee's application for new license, as approved by the Commission.

2.3 YCWA's Proposed Condition GS3: Pass Sediment at Our House and Log Cabin Diversion Dams[13, 14]

Licensee shall, beginning in the second year of the new license term, pass sediment downstream of the Our House and Log Cabin diversion dams by opening the low level (5-foot diameter) outlet valves in the dams.

Specifically, at Our House Diversion Dam, at least once between November 1 and March 15 of each year and when the Lohman Ridge Diversion Tunnel intake is fully open, Licensee shall open the valve to full capacity for 48 continuous hours when mean daily flow immediately downstream of the dam is equal to or greater than 600 cfs and Licensee anticipates mean daily flow downstream of the dam will increase to at least 1,000 cfs within 24 hours of opening the valve. However, Licensee may close the valve during the 48-hour period described in the preceding sentence if flows downstream of the dam drop below 600 cfs during that period.

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[8] See Articles 18 and 47 in existing license.
[9] This plan is included in Appendix E3 of Exhibit E of Application for New License.
[10] This condition overlaps in part with Article 19 in FERC's Form-L5 Standard Articles.
[11] This plan is included in Appendix E3 of Exhibit E of Application for New License.
[12] This condition overlaps in part with Articles 19 and 21 in FERC's Form-L5 Standard Articles.
[13] YCWA's proposed Condition GS3 assumes that the maximum capacities of Our House Diversion Dam's and Log Cabin Diversion Dam's low level (5-foot diameter) outlet valves are 600 cfs and 540 cfs, respectively, when the impoundment behind the dam is at the invert elevation of the diversion tunnel. YCWA plans to rate each outlet in spring 2015. After receiving the spring 2015 rating, YCWA may amend this proposed condition.
[14] This condition overlaps in part with Article 21 in FERC's Form-L5 Standard Articles.

At Log Cabin Diversion Dam, at least once between November 1 and March 15 of each year inclusive and when the Camptonville Diversion Tunnel intake is fully open, Licensee shall open the valve to full capacity for 48 continuous hours when mean daily flow immediately downstream of the dam is equal to or greater than 540 cfs and Licensee anticipates mean daily flow downstream of the dam will increase to at least 1,000 cfs within 24 hours of opening the valve. However, Licensee may close the valve during the 48-hour period described in the preceding sentence if flows downstream of the dam drop below 540 cfs during that period.

To maximize flow through each low level (5-foot diameter) outlet valve, Licensee shall close the fish release valve in the dam immediately after the low level valve is open, and open the fish release valve immediately before closing the low level valve. Each opening and each closing of the valves may be made in one valve adjustment (i.e., ramping is not required).

Licensee shall initiate this procedure at each dam at least once between November 1 and March 15 of each year during which favorable conditions (i.e., mean daily flow above target (600 cfs at Our House Diversion Dam and 540 cfs at Log Cabin Diversion Dam) and 1,000 cfs flow expected within 24 hours of opening the valve, and safe conditions) exist.

For compliance with this condition, the mean daily flow downstream of Our House Diversion Dam shall be measured at USGS streamflow gage 11408880 and the mean daily flow downstream of Log Cabin Diversion Dam shall be measured at USGS streamflow gage 11409400.

Upon approval of the Forest Service, USFWS, SWRCB and CDFW and notification to the Commission as soon as possible but no later than 10 days in advance, the requirements of this condition may be suspended for 1 water year.

2.4 YCWA's Proposed Condition GS4: Monitor Channel Morphology Downstream of Our House and Cabin Diversion Dams

Licensee shall, in the first year of the new license term and then in years following the first, fifth and tenth years in which the low level (5-foot diameter) outlet valve in Our House Diversion Dam is opened to pass sediment, as specified in Licensee's proposed Condition GS3, monitor channel morphology at the following sites:

- Middle Yuba River – The site is named "*Study Site 2 - Middle Yuba River Upstream of Oregon Creek*" in relicensing. Specifically, the site is located between RM 4.8 and 5.1, is approximately 1,610 feet long (i.e., more than 20 bankfull widths in length), and includes three cross-sections (numbers 2, 9 and 12 in the relicensing study).[15]

[15] Yuba County Water Agency. 2012. Technical Memorandum 1-1, Channel Morphology Upstream of Englebright Reservoir. Final License Application for Yuba River Development Project.

Licensee shall, in the first year of the new license term and then in years following the first, fifth and tenth years in which the low level (5-foot diameter) outlet valve in Log Cabin Diversion Dam is opened to pass sediment, as specified in Licensee's proposed Condition GS3, monitor channel morphology at the following sites:

- Oregon Creek – The site was named "*Study Site 12 – Oregon Creek Celestial Valley Sub-reach*" in relicensing. Specifically, the site is located between RM 2.2 and 2.8, is approximately 880 feet long (i.e., more than 20 bankfull widths in length), and includes three cross-sections (numbers 8, 10 and 12 in the relicensing study).[16]

Monitoring in the first year of the new license term will include set-up of cross sections and collecting data for comparison with subsequent monitoring. All monitoring will occur following the spring runoff and before October 15. The purpose of the monitoring following the first, fifth and tenth years in which the low level outlet valve in the upstream diversion dam is opened is to document changes in channel morphology and substrate related to opening the valve in the previous spring.

Field Methods

Establish Cross Sections
Licensee shall locate re-bar or pins used to measure cross sections that were previously established by Licensee's relicensing Study 1.1, *Channel Morphology Upstream of Engelebright Reservoir.*[17] Licensee shall re-establish the cross sections used in that relicensing study and monument the ends of the cross section with bedrock pins or rebar and shall take the GPS coordinate of each pin. In addition, Licensee shall establish a benchmark for each transect so that, if headpins or tailpins are lost, then elevations can be still be re-established. The cross sections established during the initial setup and monitoring in Year 1 shall be used during subsequent monitoring. Additional data collected at each cross section shall include: 1) water surface elevation; 2) thalweg; 3) breaks in slope; 4) bankfull location; 5) floodprone location; and 6) at least 30 locations between bankfull and every 4 ft beyond bankfull to edge of valley.

Wolman Pebble Count on Transect
Licensee shall measure at least 100 particles randomly selected from within the bankfull channel at each cross section using a gravelometer to measure the particle, so that particles will be recorded as "finer than" (i.e., each particle will fall through an opening; the size of the opening the particle falls through will be recorded). The location from which each particle was measured shall be recorded.

To-scale Site and Facies Map
Licensee shall, from 30 ft below the most downstream cross section to 30 ft above the uppermost cross section at the site, draw a to-scale map identifying locations of transects, bedrock and boulders, bankfull flow, and facies (i.e., collections of like-particles). Facies shall be defined by

[16] *Ibid*.
[17] *Ibid*.

dominant and sub-dominant particle type (i.e., boulder, cobble, gravel, according to the modified Wentworth scale). License shall perform a Wolman pebble count on each facies.

Residual Pool Depth

Licensee shall measure residual depth in pools within the site that meet the minimum criteria set by Schuett-Hames et al. (1999).[18]

Bank Erosion

License shall assess bank erosion using stream bank erosion methods as set out in Rosgen (1996).[19] License shall establish types of banks by classifying into categories (e.g., vertical, silt, vegetated; or 45 degree angle, cobble, sparse vegetation) and assess variables that include the ratio of streambank height to bankfull stage, ratio of riparian vegetation rooting depth to streambank height, degree of rooting density, the composition of streambank materials, streambank angle, bank material stratigraphy and presence of soil lenses, and bank surface protection afforded by debris and vegetation. Licensee shall note the location of the bank types on the site map.

Channel Stability

Licensee shall classify the channel into like-types (e.g., alluvial and self-formed or bedrock and imposed channel form) and evaluate channel stability using the Pfankuch (1975)[20] checklist. A numerical value shall be assigned based on the answers to a suite of questions about upper and lower banks, and the stream substrate. This numerical value shall be converted to a bank condition by stream type (i.e., "Excellent" to "Poor"); each site would then have a range of values that represented the site condition. Licensee shall note the location of the channel types on the site map.

Photographs

Licensee shall take digital photographs from each endpoint of each transect (i.e., from valley wall and near-channel endpoints) from downstream looking upstream at each transect, and from upstream looking downstream at each transect. Additional photo points may be established at features particularly likely to change over time, such as mid-channel or lateral bars composed of 64 mm particles or less. Licensee shall monument the photopoint and state the azimuth the camera is pointed from photopoint to object, and describe what is shown in the photo.

Fine Particles in Spawning-size Gravel

Particle size distribution and fine sediment content of potential resident rainbow trout spawning gravels shall be determined using bulk sampling techniques (McNeil and Ahnell 1960).[21] Three bulk samples shall be collected within suitable gravel patches using a modified McNeil sampler

[18] Schuett-Hames, D., A.E. Pleus, J. Ward, M. Fox and J. Light. 1999. Method Manual for the Large Woody Debris Survey. Northwest Indian Fisheries Commission, Timber Fish and Wildlife. TFW-AM9-99-004. 66 pp.

[19] Rosgen, D.L. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.

[20] Pfankuch, D.J. 1975. Stream reach inventory and channel stability evaluation. USDA Forest Service, R1-75-002. Washington, D.C. 26 pp.

[21] McNeil, W.J. and W.H. Ahnell. 1960. Success of pink salmon spawning relative to size of spawning bed materials. Contribution No. 157, College of Fisheries, University of Washington, USDOI Fish and Wildlife Service.

(i.e., bottomless bucket; based on design presented by Watschke and McMahon [2005][22]). Samples shall be taken to a depth of 10 to 15 centimeters (cm), which approximates the depth of a rainbow trout egg pocket in a redd (Watschke and McMahon 2005). All sampled sediments shall be placed in a woven plastic bag that allow drainage of water and a slight amount of the wash load (i.e., particles less than 2 mm), and delivered to a lab for dry-sieve analysis.

Data Analysis

Cross section, pebble count, bank erosion, channel stability, and residual pool depth data shall be entered into and organized in an electronic spreadsheet. The area that is contained within each facies shall be quantified using the to-scale map. Reach-average D_{50} and the D_{50} of each facies and transect shall be estimated, along with a particle size distribution. Reach-averaged D_{50} shall be calculated by estimating the area for each facies, multiplying the fractional area of the facies by the D_{50} of that facies, and summing the products for the reach.

Particle size composition of spawning-size gravel samples shall be plotted as cumulative distribution curves and frequency histogram. Particle size composition as represented by the D_{16}, D_{50}, and D_{84} shall be determined from the frequency histogram and cumulative distribution curve. Raw data results for each sample (i.e., three per site; taken from one to three locations within the site) shall be presented in the graphs and tables.

Photographs shall be organized into an electronic file.

Licensee shall have the data for each subsequent monitoring event analyzed in a similar fashion, for ease of comparison.

Reporting

Licensee shall prepare a monitoring report for each year in which channel morphology monitoring occurs. The report shall include sections on the purpose of the monitoring; methods; a description of implementation of Licensee's proposed Condition GS3 since the last monitoring report, including periods that the low-level outlet valve was opened and flows prior to, during and after the valve opening; results; and discussion. A draft of each report shall be provided to the Forest Service, USACE, CDFW and SWRCB for a 45-day written comment period. Licensee shall make available the final monitoring report, including evidence of consultation, to the Forest Service, CDFW and SWRCB at least 30 days in advance of the annual consultation meeting described in Licensee's proposed Condition GEN1. If Licensee does not accept a suggested revision by an agency's written comments on the draft report, then the final monitoring report shall describe why the revision was not accepted. Licensee shall file the final monitoring report with FERC within 30 days of receiving the agencies' written comments on the draft report.

[22] Watschke, D.A. and T.E. McMahon. 2005. Journal of Freshwater Ecology, Volume 20, No. 4. pp. 795–797.

2.5 YCWA's Proposed Condition GS5: Pass Large Woody Material at Our House and Log Cabin Diversion Dams

Licensee shall allow, provided conditions permit safe and reasonable access and working conditions, mobile instream large woody material so that it passes the Our House and Log Cabin diversion dams into downstream reaches. All sizes of large woody material greater than 8 inches in diameter and up to 36 feet in length shall be allowed to pass downstream past the dams. If it is reasonably necessary to implement this condition, then Licensee may cut such woody material into shorter lengths. Notwithstanding this requirement, if the Commission or the California Division of Safety of Dams requires Licensee to remove large woody material from the dams or dam spillways, then Licensee shall do so; and if a federal or state agency or Yuba County expresses a concern about the potential effects of this condition on the safety or maintenance of downstream bridges, then Licensee shall not implement this condition. Licensee shall not be required to maintain or otherwise fund maintenance of downstream bridges, or otherwise be responsible for damages to downstream bridges due to passage of large woody material.

3.0 Water Resources

3.1 YCWA's Proposed Condition WR1: Implement Hazardous Materials Management Plan[23, 24]

Licensee shall implement the Hazardous Materials Management Plan included in Licensee's application for new license, as approved by the Commission.

3.2 YCWA's Proposed Condition WR2: Determine Water Year Types for Conditions Pertaining to Our House Diversion Dam, Log Cabin Diversion Dam and New Bullards Bar Dam

Beginning within the first 90 days of the new license term, Licensee shall in each year in each of the months of February, March, April, May and October determine the applicable water year type described in Table 3.2-1 of this condition. Licensee shall use this determination to implement articles and conditions of the license that are dependent on water year type and that concern flows in the Middle Yuba River downstream of Our House Diversion Dam, in Oregon Creek downstream of Log Cabin Diversion Dam and in the North Yuba River downstream of New Bullards Bar Dam. Water year types for these articles and conditions shall be defined as listed in Table 3.2-1 of this condition.

[23] This plan is included in Appendix E3 of Exhibit E of Application for New License.
[24] This condition addresses Forest Service's "Standard" Administrative Condition 21, *Hazardous Substance Plan*, based on FPA Section final 4(e) conditions recently filed by the Forest Service with FERC on hydro relicensings in the Yuba River upstream of the Project.

Table 3.2-1. Water Year types for the Yuba River Development Project in the Middle Yuba River downstream of Our House Diversion Dam, in Oregon Creek downstream of Log Cabin Diversion Dam and in the North Yuba River downstream of New Bullards Bar Dam.

Water Year Type	DWR Forecast of Total Unimpaired Runoff in the Yuba River at Smartsville in Thousand Acre-Feet or DWR Full Natural Flow Near Smartsville for the Water Year in Thousand Acre-Feet[1]
Wet	Greater than 3,240
Above Normal	2,191 to 3,240
Below Normal	1,461 to 2,190
Dry	901 to 1,460
Critically Dry	616 to 900
Extreme Critically Dry[2]	Equal to or Less than 615

[1] DWR rounds the Bulletin 120 forecast to the nearest 1,000 acre-feet. The Full Natural Flow is provided to the nearest acre-foot, and Licensee will round DWR's Full Natural Flow to the nearest 1,000 acre-feet.
[2] A Critically Dry Water Year that follows an Extreme Critically Dry Water Year or a Critically Dry Water Year shall be considered an Extreme Critically Dry Water Year.

In each of the months of February, March, April and May, the water year type shall be based on California Department of Water Resources (DWR) water year forecast of unimpaired runoff in the Yuba River at Smartsville as set forth in DWR's Bulletin 120 entitled "Water Year Conditions in California." DWR's forecast published in February, March and April shall apply from the 15th day of that month to the 14th day of the next month. From May 15 through October 14, the water year type shall be based on DWR's forecast published in May.

From October 15 through February 14 of the following year, the water year type shall be based on the sum of DWR's monthly (not daily) full natural flow for the full water year for the Yuba River near Smartsville, as made available by DWR on the California Data Exchange Center (CDEC) in the folder named "FNF Sum." (Currently these data are available at: http://cdec.water.ca.gov/cgi-progs/stages/FNFSUM). If DWR does not make the full natural flow for the full water year available until after October 14 but prior to or on October 31, from 3 days after the date the full natural flow is made available until February 14 of the following year, the water year type shall be based on the sum of DWR's monthly full natural flow for the full water year as made available. If DWR does not make available the final full natural flow by October 31, the water year type from November 1 through February 14 of the following year shall be based on DWR's May Bulletin 120.

3.3 YCWA's Proposed Condition WR3: Determine Water Year Types for Conditions Pertaining to Narrows 2 Powerhouse and Narrows 2 Full Bypass[25]

Beginning within the first 90 days of the new license term, Licensee shall, using the California Department of Water Resources (DWR)-published Bulletin 120 each year in each of the months of February, March, April and May, and then thereafter whenever DWR issues an update to the Bulletin 120, determine the applicable water year type as described in Table 3.3-1 of this

[25] The schedules in this proposed condition are the same as the schedules described in Exhibits 2, 4 and 5 of the Lower Yuba River Fisheries Agreement. The instream flow requirements in the SWRCB's Corrected Order WR 2008-0014 are based on these flow schedules. (See SWRCB Corrected Order WR 2008-0014, p. 59, term 5.)

condition. Licensee shall use this determination to implement articles and conditions of the license that are dependent on water year type and that concern flows in the Yuba River downstream of the combined releases of Narrows 2 Powerhouse and Narrows 2 Full Bypass. Water year types for these articles and conditions shall be based on the North Yuba Index as defined in Table 3.3-1 of this condition.

Table 3.3-1. North Yuba Index.

Water Year Type	Thousands of Acre-Feet
Schedule 1	Equal to or greater than 1,400
Schedule 2	Equal to or greater than 1,040 and less than 1,400
Schedule 3	Equal to or greater than 920 and less than 1,040
Schedule 4	Equal to or greater than 820 and less than 920
Schedule 5	Equal to or greater than 693 and less than 820
Schedule 6	Equal to or greater than 500 and less than 693
Conference Year	Less than 500

The North Yuba Index shall be defined as follows:

$$\text{North Yuba Index} = Sa^{NBB} + I^{NBB}$$

where Sa^{NBB} is the actual recorded amount of water in storage in New Bullards Bar Reservoir on September 30 of the previous water year as reported for USGS gage 11413515 minus 234,000 acre-feet; and I^{NBB} is calculated as follows:

$$I^{NBB} = \text{Total Actual Inflow to New Bullards Bar Reservoir from October 1 to the end of Month}^{i-1}$$
$$+ \text{Forecasted Inflow from the Beginning of Month}^{i} \text{ to September 30}$$

(Month^{i-1} is the previous month and Month^{i} is the current month)

where Total Actual Inflow to New Bullards Bar Reservoir from October 1 to the end of Month^{i-1} is the calculated inflow in thousands of acre-feet based on a monthly summation of inflow as follows:

$$\text{Total Actual Inflow to New Bullards Bar Reservoir from October 1 to the end of Month}^{i-1}$$
$$= \text{Monthly change in stored water} + \text{Monthly outflow}$$

and where the Forecasted Inflow from the Beginning of Month^{i} to September 30 is calculated as follows:

$$\text{Forecasted Inflow to NBB}^{i} = \text{February NBB Inflow}$$
$$+ \text{March Inflow} + \text{April-July Inflow} + \text{August-September Inflow}$$

Forecasted inflow to NBB shall be determined for each month using statistically-derived linear coefficients shown in Table 2 of this condition, applied to the measured inflow to New Bullards Bar Reservoir and the CDWR's Bulletin 120 for February, March, April, and May, and subsequent updates of forecasts of unimpaired flow of the North Yuba River at Goodyears Bar (USGS Gage 11413000) and at the Yuba River at Smartsville (USGS Gage 11418000).

Table 3.3-2. Coefficients for the calculation of Forecasted Inflow from the beginning of "Month^{i}" to September 30.

Forecast Month	Forecasted For	Constant (C) (ac-ft)	Total Actual Inflow to New Bullards Bar Reservoir[3] (C1) (no units)	Bulletin 120[2,4] Forecasted Smartsville (C2) (no units)	Bulletin 120[2] Forecasted Goodyear's Bar (C3) (no units)
February	February	-2,146	0.01424	0.52533	--
	March	-3,221	0.02458	0.54787	--
	April-July	-30,416	0.01413	0.62473	-0.24081
	August-September	--	0.01593	0.64037	--
March	March	-23,495	0.00596	0.55386	--
	April-July	-31,134	0.01237	0.62162	-0.23266
	August-September	--	0.01473	0.59396	--
April	April-July	-30,665	0.00547	0.61332	-0.19623
	August-September	--	0.01409	0.53241	--
May[1,5]	April-July	-31,652	0.01033	0.61645	-0.22353
	August-September	--	0.01298	0.50071	--

[1] For all subsequent forecast updates, the May coefficients shall be used, with the forecasted Goodyears Bar runoff equaling 0.273 times the current forecasted Yuba River unimpaired flow at Smartsville.
[2] The Bulletin 120 forecasted flow for Smartsville and Goodyears Bar shall use the 50-percent exceedance forecasted flow.
[3] Total actual inflow means inflow to date from October 1 of the previous year
[4] "Forecasted Smartsville" is the DWR forecast for "Yuba River at Smartsville Plus Deer Creek"
[5] The May calculation of Forecasted NBB Inflow and subsequent updated calculations shall be reduced by the actual NBB inflow between April 1 and the calculation date.

Formula terms are only applicable as shown in Table 3.3-2 (e.g. the March forecast does not include a term for forecasted February NBB Inflow). The following formula shall be used to calculate the terms of the formula for Forecasted Inflow to NBB^{i} using the corresponding coefficients from Table 3.3-2:

- February NBB Inflow = C + C1 x Total Actual Inflow to NBB + C2 x Forecasted Smartville$^{(February)}$
- March NBB Inflow = C + C1 x Total Actual Inflow to NBB + C2 x Forecasted Smartville$^{(March)}$
- April – July Inflow = C + C1 x Total Actual Inflow to NBB + C2 x Forecasted Smartville$^{(April - July)}$ + C3 x Forecasted Goodyears Bar$^{(April - July)}$
- August - September Inflow = C1 x Total Actual Inflow to NBB + C2 x Forecasted Smartville$^{(August - September)}$

Terms are calculated in ac-ft and the result is converted to thousands of ac-ft for use in the calculation of the Forecasted Total Inflow to New Bullards Bar (I^{NBB} (TAF).

3.4 YCWA's Proposed Condition WR4: Implement Streamflow and Reservoir Level Monitoring Plan[26, 27]

Licensee shall implement the Streamflow and Reservoir Level Monitoring Plan included in Licensee's application for new license, as approved by the Commission.

[26] This plan is included in Appendix E3 of Exhibit E of Application for New License.
[27] This condition overlaps in part with Article 8 in FERC's Form-L5 Standard Articles.

3.5 YCWA's Proposed Condition WR5: Maintain New Bullards Bar Reservoir Minimum Pool[28]

Licensee shall make a good faith effort to maintain a minimum pool in New Bullards Bar Reservoir at elevation 1,730 feet, except for drawdowns below this elevation that are necessary to meet the minimum streamflow requirements in this license.

3.6 YCWA's Proposed Condition WR6: Operate New Bullards Bar Reservoir for Flood Control[29]

Licensee shall operate Project reservoirs for flood control in accordance with rules prescribed by the secretary of the Army.

4.0 Aquatic Resources

4.1 YCWA's Proposed Condition AR1: Maintain Minimum Streamflows Downstream of Our House Diversion Dam, Log Cabin Diversion Dam, and New Bullards Bar Dam

Licensee shall meet the minimum streamflow requirements for the Middle Yuba River downstream of Our House Diversion Dam, for Oregon Creek downstream of Log Cabin Diversion Dam and for the North Yuba River downstream of New Bullards Bar Dam that are shown in Table 4.1-1 of this condition. Licensee shall record streamflow at all of the gages listed in this table, as required by USGS (Article 8 of FERC's Form L-5, Standard Articles).

Minimum streamflows shall be measured in cubic feet per second (cfs) once every 15-minute. Minimum streamflows may be temporarily modified as follows:

- For short periods and upon consultation with and approval by the Forest Service, USFWS, CDFW and SWRCB. Licensee shall provide notification to the Commission prior to implementing such modifications.
- Due to an emergency. An emergency is defined as an outage due to an event that is reasonably out of the control of Licensee and requires Licensee to take immediate action, either unilaterally or under instruction of law enforcement, emergency services, California ISO or other regulatory agency staff, including actions to prevent the imminent loss of human life or damage to property. An emergency may include, but is not limited to: natural events such as landslides, storms, or wildfires; vandalism; malfunction or failure of PG&E Transmission lines or Project works; or other public safety incidents. If Licensee temporarily modifies the requirements of this condition, Licensee shall make all reasonable efforts to promptly resume performance of the requirements, and shall notify

[28] The proposed minimum New Bullards Bar Reservoir minimum elevation is the same as in Article 34 in the existing license.
[29] The proposed flood control condition is similar to Article 46 in the existing license.

the Forest Service, USFWS, CDFW and the SWRCB within 48 hours of the start of the modification. Licensee shall provide notification to the Commission as soon as possible but no later than 10 days after such incident.

Except as otherwise provided, Licensee shall implement the minimum streamflows shown in Tables 4.1-1 of this condition beginning in the first 90 days of the new license term unless a facility modification or construction is necessary. Changes between minimum streamflow values may be made with one adjustment to the controlling valve (i.e., ramping from one minimum flow to another minimum flow is not required).

Where a facility must be modified or constructed to allow compliance with the required minimum streamflows, including flow measurement facilities, then, except as otherwise provided, Licensee shall submit applications for permits to modify or construct the facility as soon as reasonably practicable but no later than within the first 2 years of the new license term, and Licensee will complete the work as soon as reasonably practicable but no later than within 2 years after receiving all required permits and approvals for the work. During the period before facility modifications or construction are completed, and within the first 90 days of the new license term, Licensee shall make a good faith effort to provide the specified minimum streamflows within the reasonable capabilities of the existing facilities.

Table 4.1-1. Minimum Streamflows in cubic feet per second (cfs) for the Yuba River Development Project by month and Water Year Type, which is defined in Licensee's proposed Condition WR2.

Month	Wet Water Year	Above Normal Water Year	Below Normal Water Year	Dry Water Year	Critically Dry Water Year	Extreme Critically Dry Water Year
MIDDLE YUBA RIVER - BELOW OUR HOUSE DIVERSION DAM (COMPLIANCE POINT: USGS STREAMFLOW GAGE 11408880)						
October 1 - 30	57*	57*	57*	49*	35*	21*
November 1-30	57*	57*	57*	49*	35*	21*
December 1 - 31	57*	57*	57*	49*	35*	21*
January 1 - 31	57*	57*	57*	49*	35*	21*
February 1- 29	57*	57*	57*	49*	35*	21*
March 1 - 31	80*	66*	57*	49*	35*	21*
April 1 - 30	80*	66*	57*	49*	35*	21*
May 1- 31	80*	66*	57*	49*	35*	21*
June 1 - 30	80*	66*	57*	49*	35*	21*
July 1 - 31	80*	66*	57*	49*	35*	21*
August 1 - 31	80*	66*	57*	49*	35*	21*
September 1- 30	80*	66*	57*	49*	35*	21*
OREGON CREEK - BELOW LOG CABIN DIVERSION DAM (COMPLIANCE POINT: USGS STREAMFLOW GAGE 11409400)						
October 1 - 30	8*	8*	8*	6*	6*	6*
November 1-30	8*	8*	8*	6*	6*	6*
December 1 - 31	8*	8*	8*	6*	6*	6*
January 1 - 31	8*	8*	8*	6*	6*	6*
February 1- 29	8*	8*	8*	6*	6*	6*
March 1 - 31	13*	10*	8*	6*	6*	6*
April 1 - 30	31*	26*	21*	18*	12*	6*
May 1- 31	31*	26*	21*	18*	12*	6*
June 1 - 30	31*	26*	21*	18*	12*	6*
July 1 - 31	13*	10*	8*	6*	6*	6*

Table 4.1-1. (continued)

Month	Wet Water Year	Above Normal Water Year	Below Normal Water Year	Dry Water Year	Critically Dry Water Year	Extreme Critically Dry Water Year
OREGON CREEK - BELOW LOG CABIN DIVERSION DAM (COMPLIANCE POINT: USGS STREAMFLOW GAGE 11409400) (cont.)						
August 1 - 31	13*	10*	8*	6*	6*	6*
September 1- 30	13*	10*	8*	6*	6*	6*
NORTH YUBA RIVER - BELOW NEW BULLARDS BAR DAM (COMPLIANCE POINT: USGS STREAMFLOW GAGE 11413517)						
October 1 - 30	13	13	13	13	7	5
November 1-30	13	13	13	13	7	5
December 1 - 31	13	13	13	13	7	5
January 1 - 31	13	13	13	13	7	5
February 1- 29	13	13	13	13	7	5
March 1 - 31	11	12	13	13	7	5
April 1 - 30	5	5	5	5	5	5
May 1- 31	5	5	5	5	5	5
June 1 - 30	5	5	5	5	5	5
July 1 - 31	11	12	13	13	7	5
August 1 - 31	11	12	13	13	7	5
September 1-– 30	11	12	13	13	7	5

* Or natural inflow if natural inflow is less.

Minimum flow releases are not required from the New Colgate Powerhouse.

4.2 YCWA's Proposed Condition AR2: Control Project Spills at Our House Diversion Dam[30]

Licensee shall, from May 1 through July 15 of each year, implement a spill cessation schedule at Our House Diversion Dam by adjusting the low level (5-foot diameter) outlet valve in the dam. Specifically, when a spill at the dam of greater than 200 cfs mean daily flow occurs, measured as the amount of flow below the dam that is above the required minimum flow at that time, Licensee shall commence spill reduction measures to operate the low level outlet valve as follows:

1. For average daily flows below the dam greater than the required instream flow plus 600 cfs, (i.e. the release capacity of the 5 ft diameter sluice valve at a dam crest pool elevation), once the flow below the dam recedes to 600 cfs plus the required minimum instream flow, Licensee shall fully open the low level outlet.
2. After a minimum of 48 hours with the low level outlet valve fully open, Licensee shall close the low level outlet valve gradually so that flows below the dam do not reduce faster than a rate of 100 cfs every 48 hours due to low level outlet valve opening reductions.

[30] YCWA's proposed Condition AR2 assumes that the maximum capacity of Our House Diversion Dam's low level (5-foot diameter) outlet valve is 600 cfs when the impoundment behind the dam is at the invert elevation of the Lohman Ridge Diversion Tunnel. YCWA plans to rate the outlet in spring 2015. Based on the spring 2015 rating, YCWA may amend this proposed condition.

3. For average daily flows below the dam less than the required minimum instream flow plus 600 cfs, once flows begin to recede, Licensee shall open the low level outlet valve to the point where water is no longer spilling over the dam. The low level outlet valve opening shall remain at that amount for a minimum of 48 hours, at which time Licensee shall close the low level outlet valve gradually so that flows below the dam do not reduce faster than a rate of 100 cfs every 48 hours due to low level outlet valve opening reductions.
4. If, during the time License is implementing paragraphs 1,2 and 3 above, the dam pool elevation due to inflow to the impoundment lowers (i.e., not Licensee's operation of the low level outlet) such that the low level outlet valve release is reduced faster than 100 cfs every 48 hours. License shall make valve opening reductions no faster than 20 percent of full valve stem rise every 48 hours, until the low level outlet valve is fully closed.
5. If, during the time License is implementing paragraphs 1, 2 and 3 above, the flow below the dam increases as a result of increased inflow into the impoundment and re-initiation of spill over the dam occurs, License shall open the low level outlet valve to eliminate spill at the dam and the low level outlet valve opening will remain at that amount a minimum of 48 hours, and the procedure of stepwise closing of the valve, as described in bullet 4 above, will commence. If the reinitiated spill results in a flow greater than the required minimum instream flow plus 600 cfs below the dam, Licensee shall close the low level outlet valve until such time as this operation can commence again.
6. If, during the time License is implementing paragraphs 1,2 and 3 above, the flow below the dam increases as a result of increased inflow into the impoundment and re-initiation of spill over the dam does not occurs, License shall maintain the current opening of the low level outlet valve for that day.

The fish release valve and Lohman Ridge Diversion Tunnel shall remain open throughout this procedure.

For the purposes of this condition: 1) The mean daily flow shall be measured downstream of Our House Diversion Dam at USGS streamflow gage 11408880; 2) compliance for this measure when pool elevations do not allow compliance with the flow ramping rate shall be adjustments to the valve as stem rise changes; 2) opening and closing valves between the valve settings described above may be made in one valve adjustment (i.e., ramping between settings is not required); and 3) the valve adjustments shall be made by noon on the day following the day the flow below the dam triggers this operation, providing there is safe access to the site.

Licensee shall make available to the Forest Service, SWRCB and CDFW the streamflow records related to the spill cessation schedules upon request.

This condition does not apply in instances when Licensee is directed by the Commission or California Division of Safety of Dams to test (i.e., exercise) valves at the dams (i.e., quickly open and close the valve). Licensee shall make a good faith effort to schedule such tests after September of each calendar year to avoid adverse effects on aquatic species.

This condition is subject to temporary modification if required by equipment malfunction, as directed by law enforcement authorities, or in emergencies. An emergency is defined as an outage due to an event that is reasonably out of the control of Licensee and requires Licensee to take immediate action, either unilaterally or under instruction of law enforcement, emergency services, or other regulatory agency staff, including actions to prevent or reduce the imminent loss of human life or damage to property. An emergency may include, but is not limited to: natural events such as landslides, storms, or wildfires; vandalism; malfunction or failure of Project works; or other public safety incidents. If Licensee temporarily modifies the requirements of this condition, Licensee shall make all reasonable efforts to promptly resume performance of the requirements and shall notify the Forest Service, SWRCB, and CDFW within 48 hours of the modification. Licensee shall provide notification to the Commission as soon as possible but no later than 10 days after such incident.

Licensee shall commence the dam spill cessation schedules in this part within the first 90 days of the new license term unless a facility modification or construction is required. Where a facility must be modified or constructed to allow compliance with the required spill cessation schedule, including flow measurement facilities, except as otherwise provided, Licensee shall submit applications for permits to modify or construct the facilities as soon as reasonably practicable but no later than within the first 2 years of the new license term, and will complete the work as soon as reasonably practicable but no later than 2 years after receiving all required permits and approvals for the work. During the period before facility modifications or construction are completed, and starting within the first 90 days of the new license term, Licensee shall make a good faith effort to provide the specified spill cessation schedules within the reasonable capabilities of the existing facilities.

4.3 YCWA's Proposed Condition AR3: Maintain Minimum Streamflows Downstream of Narrows 2 Powerhouse and Narrows 2 Full Bypass

Licensee, in coordinated operations with the licensee for the Narrows Project (FERC No. 1403) under the coordinated operations agreement or Commission order described in License's proposed Condition GEN7, shall meet the minimum streamflows in the Yuba River shown in Table 4.3-1 of this condition. These streamflows shall be measured at the indicated USGS gages, which are located downstream of the combined releases of the Narrows Project, the Narrows 2 Powerhouse and the Narrows 2 Full Bypass. Licensee shall record minimum streamflow at all gages as required by USGS (Article 8 of FERC's Form L-5, Standard Articles).

Table 4.3-1. Minimum Streamflows in cubic feet per second (cfs) for the Yuba River Development Project by month and Water Year Type, which is defined in Licensee's proposed Condition WR3.

Month	Schedule 1	Schedule 2	Schedule 3	Schedule 4	Schedule 5	Schedule 6	Conference Year
YUBA RIVER - BELOW NARROWS 2 POWERHOUSE/NARROWS 2 FULL BYPASS (COMPLIANCE POINT: USGS STREAMFLOW GAGE 11418000)							
October 1 – 15	700	700	700	700	600	600	500
October 16 - 31	700	700	700	700	600	600	550
November 1 - 30	700	700	700	700	600	600	550
December 1 - 31	700	700	700	700	550	550	550

Table 4.3-1. (continued)

Month	Schedule 1	Schedule 2	Schedule 3	Schedule 4	Schedule 5	Schedule 6	Conference Year
YUBA RIVER - BELOW NARROWS 2 POWERHOUSE/NARROWS 2 FULL BYPASS (COMPLIANCE POINT: USGS STREAMFLOW GAGE 11418000) (cont.)							
January 1- 15	700	700	700	700	550	550	550
January 16 – 31	700	700	700	700	550	550	550
February 1 - 29	700	700	700	700	550	550	550
March 1- 31	700	700	700	700	550	550	550
April 1 – 15	700	700	700	700	600	600	500
April 16 – 30	--	--	--	--	--	--	--
May 1 – 15	--	--	--	--	--	--	--
May 16 – 31	--	--	--	--	--	--	--
June 1 - 15	--	--	--	--	--	--	--
June 16 – 30	--	--	--	--	--	--	--
July 1 – 31	--	--	--	--	--	--	--
August 1 – 31	--	--	--	--	--	--	--
September 1 – 30	700	700	700	700	500	500	500
YUBA RIVER - BELOW NARROWS 2 POWERHOUSE/NARROWS 2 FULL BYPASS (COMPLIANCE POINT: USGS STREAMFLOW GAGE 11421000)							
October 1 - 15	500	500	500	400	400	350	350
October 16 - 31	500	500	500	400	400	350	350
November 1 - 30	500	500	500	500	500	350	350
December 1 - 31	500	500	500	500	500	350	350
January 1- 15	500	500	500	500	500	350	350
January 16 – 31	500	500	500	500	500	350	350
February 1 - 29	500	500	500	500	500	350	350
March 1- 31	700	700	500	500	500	350	350
April 1 - 15	1,000	700	700	600	500	350	300
April 16 - 30	1,000	800	700	900	600	500	245
May 1 - 15	2,000	1,000	900	900	600	500	245
May 16 - 31	2,000	1,000	900	600	400	400	245
June 1 - 15	1,500	800	500	400	400	300	245
June 16 - 30	1,500	500	500	400	400	150	245
July 1 - 31	700	500	500	400	400	150	150
August 1 - 31	600	500	500	400	400	150	150
September 1 - 30	500	500	500	400	400	350	150

Minimum streamflows in this condition shall mean the 5-day running average of average daily streamflows, with the 15-minute flows not less than 90 percent of the specified flow requirement in Table 4.3-1 of this condition. In addition, 15-minute flows shall not be less than the applicable flow requirement specified in Table 4.3-1 for more than 48 consecutive hours.

Minimum streamflows in this condition may be temporarily modified for short periods, as necessary for powerhouse outages required for inspections and maintenance purposes, upon approval of the Commission.

Minimum streamflows may be temporarily modified due to an emergency. An emergency is defined as an outage due to an event that is reasonably out of the control of Licensee and requires Licensee to take immediate action, either unilaterally or under instruction of law enforcement, emergency services, California ISO or other regulatory agency staff, including actions to prevent or reduce the imminent loss of human life or damage to property. An emergency may include, but is not limited to: natural events such as landslides, storms, or wildfires; vandalism; malfunction or failure of PG&E Transmission lines or Project works; or other public safety incidents. If Licensee temporarily modifies the requirements of this condition due to an emergency, Licensee shall make all reasonable efforts to promptly resume performance of the requirements, and shall notify the NMFS, USFWS, CDFW and the SWRCB within 48 hours of the start of the modification. Licensee shall provide notification to the Commission as soon as possible but no later than 10 days after such incident.

If any of the minimum flow requirements in the SWRCB's Corrected Order WR 2008-0014 are temporarily modified by the SWRCB or its Deputy Director for Water Rights, and if Licensee, NMFS, USFWS and CDFW agree, then Licensee may make corresponding temporary modifications to the requirements in this condition. Licensee shall provide notification to the Commission as soon as possible but no later than 10 days after such incident.

4.4 YCWA's Proposed Condition AR4: Control Project Spills at New Bullards Bar Dam

Licensee shall, beginning in the first full calendar year after license issuance, reduce flows through the New Bullards Bar Dam spillway in the following manner after any spill releases that occur between May 1 and July 31 after water is no longer stored in the Flood Reservation Space above elevation 1,918 feet. For spill events greater than 2,000 cfs, as inflows into the reservoir recede and the spill is at 2,000 cfs and reducing, the spill will be reduced at a target rate no greater than 250 cfs per day until the spill has ceased. If a spill of less than 2,000 cfs occurs, then the spill release will be reduced from the peak spill flow target rate by at a target rate no greater than 250 cfs per day until the spill has ceased.

Compliance with this measure will be the adjustments to spillway gate opening to meet the ramping rate as determined by Licensee's calculation of spillway gate release.

4.5 YCWA's Proposed Condition AR5: Implement Aquatic Invasive Species Management Plan[31]

Licensee shall, in the first year of the new license term, implement the Aquatic Invasive Species Management Plan included in Licensee's application for new license, as approved by the Commission.

[31] This plan is included in Appendix E3 of Exhibit E of Application for New License.

4.6 YCWA's Proposed Condition AR6: Implement New Bullards Bar Reservoir Fish Stocking Plan[32]

Licensee shall, in the first year of the new license term, implement the New Bullards Bar Reservoir Fish Stocking Plan included in Licensee's application for new license, as approved by the Commission.

5.0 Terrestrial Resources

5.1 YCWA's Proposed Condition TR1: Implement Integrated Vegetation Management Plan[33, 34]

Licensee shall, in the first year of the new license term, implement the Integrated Vegetation Management Plan (IVMP) included in Licensee's application for new license, as approved by the Commission.

5.2 YCWA's Proposed Condition TR2: Implement Bald Eagle and American Peregrine Falcon Management Plan[35]

Licensee shall, in the first year of the new license term, implement the Bald Eagle and American Peregrine Falcon Management Plan included in Licensee's application for new license, as approved by the Commission.

5.3 YCWA's Proposed Condition TR3: Implement Ringtail Management Plan[36]

Licensee shall, in the first year of the new license term, implement the Ringtail Management Plan included in Licensee's application for new license, as approved by the Commission.

5.4 YCWA's Proposed Condition TR4: Manage Bats

Licensee shall, in the first year of the new license term, document all known bat roosts within Project buildings (e.g., powerhouses, storage buildings and valve houses), dams, or other structures that may be used as a roosting structure by bats. The results of the inspection will be provided to CDFW, and to the Forest Service if the facility is located on NFS land, at least 90 days prior to the annual consultation meeting described in Licensee's proposed Condition GEN1 that follows collection of the information. If bats or signs of roosting are present where staff have a routine presence (i.e., at least daily or weekly), Licensee will attempt, where feasible, and

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[32] This plan is included in Appendix E3 of Exhibit E of Application for New License.
[33] This plan is included in Appendix E3 of Exhibit E of Application for New License.
[34] This condition overlaps in part with Articles 20 and 26 in FERC's Form-L5 Standard Articles.
[35] This plan is included in Appendix E3 of Exhibit E of Application for New License.
[36] This plan is included in Appendix E3 of Exhibit E of Application for New License.

in the calendar year following the annual consultation meeting described above, to place humane exclusion devices to prevent occupation of the structure by bats. Humane exclusion devices will be placed when bats are absent from the facility, generally between November 1 and February 28. Prior to installation of the humane exclusion devices, Licensee shall perform an inspection of the facility to ensure that overwintering bats are not trapped. If overwintering bats are present during the inspection, installation of humane exclusion measures shall be delayed. Licensee shall notify CDFW, and the Forest Service if the facility is located on NFS land, of the overwintering bats. Licensee shall consult with the CDFW and the Forest Service if the facility is located on NFS land, during the annual consultation meeting described in Licensee's proposed Condition GEN1 to identify future dates that would be suitable for installation of humane exclusion devices. All exclusion devices will be inspected on an annual basis and the facility will be reevaluated for roosting bats every 3 years after the initial exclusion devices are installed to insure that no new roosts or entry points have been established.

6.0 ESA-Listed Threatened and Endangered Species

6.1 YCWA's Proposed Condition TE1: Monitor Water Temperatures Downstream of Narrows 2 Powerhouse[37]

Licensee shall, in the first 90 days of the new license term, install, maintain in proper functioning condition, and operate three water temperature monitoring recorders, one each at a suitable site at or near the following locations in the Yuba River: 1) the existing USGS Smartsville streamflow gaging station (USGS Gaging Station1141800); 2) the existing USGS Marysville streamflow gaging station (USGS Gaging Station 1142100); and 3) in the pool upstream of Daguerre Point Dam. Each recorder shall be placed in the active channel and monitor water temperature on an hourly basis, and shall have a minimum accuracy of ±0.2º Celsius. Licensee shall download water temperature data at least every 3 months, perform a quality assurance/quality control review of the data, and post the reviewed hourly water temperature data to a publically available website within 30 days of downloading the data.

6.2 YCWA's Proposed Condition TE2: Monitor Chinook Salmon Downstream of Narrows 2 Powerhouse

Beginning upon license issuance and continuing through the fourth full year of the new license term, Licensee shall each year operate continuously an infrared and/or camera-based monitoring device (e.g., VAKI Riverwatcher™ systems) in each of the North and South fish ladders in Daguerre Point Dam. Based on the data produced by the monitoring device, Licensee shall estimate number, size and timing of Chinook salmon and *Oncorhynchus mykiss* passing though the ladders. Data shall undergo a quality assurance/quality control review in consultation with the Lower Yuba Anadromous Fish Ecological Group (Group) described in Licensee's proposed Condition TE3. Beginning in the fifth full year of the new license term and annually thereafter,

[37] This proposed condition is similar to the term that was added to YCWA's water-right permits by the SWRCB's Revised Decision 1644, adopted on July 16, 2003. (See RD-1644, p. 178, term 2(d).)

Licensee shall monitor Chinook salmon and *O. mykiss* immigration into the Yuba River using an infrared or camera-based monitoring device, or such other technology as may be developed in consultation with the Group.

In addition, beginning upon license issuance and continuing through the fourth full year of the new license term, Licensee shall monitor Chinook salmon escapement each year from September 1 through January 31 (weather and river conditions permitting) by conducting weekly mark-recapture carcass surveys in the Yuba River from Daguerre Point Dam to the Simpson Lane Bridge. All fresh carcasses observed shall be sampled. All sampled carcasses (ad-clipped and non-clipped) shall be tagged for abundance estimation from the mark-recapture surveys. The following data shall be collected from each fresh carcass: 1) sex; 2) fork length in millimeters; 3) if a female carcass, egg retention status; 4) adipose fin presence;; and 5) location where the fish was observed, in Global Positioning System (GPS) coordinates. For adipose-fin clipped fish, heads will be collected, if coded wire tagging (CWT) recovery is required. Estimation of the escapement from the mark-recapture carcass surveys shall use the super-population modification of the Cormack Jolly-Seber model. Beginning in the fifth year of the new license term and annually thereafter, Licensee shall monitor escapement using the mark-recapture method described above unless an alternative method is adopted in consultation with the Group.

By April 1 of each year, Licensee shall file with the Commission an annual monitoring report for the previous calendar year. The report shall include objectives, methods and results sections and shall include raw data in appendices and an estimate of total annual escapement.

6.3 YCWA's Proposed Condition TE3: Establish Lower Yuba River Anadromous Fish Ecological Group

Licensee shall, within the first 6 months of the new license term, establish the Lower Yuba River Anadromous Fish Ecological Group (Group), whose members shall include Licensee, NMFS, USFWS, CDFW and SWRCB. The purpose of the Group shall be to assist Licensee implementing the terms and conditions of the new license that pertain to anadromous fish in the Yuba River downstream of Narrows 2 Powerhouse. Licensee shall organize at least one meeting in May and up to three additional meetings each year with the Group. The purpose of the May meetings shall be to discuss water temperature and salmonid escapement data from the previous year developed pursuant to Licensee's proposed Conditions TE1 and TE2. By April 1 of each year, Licensee shall file with the Commission an annual report of the activities of the Group for the previous calendar year.

6.4 YCWA's Proposed Condition TE4: Control Project Ramping and Flow Fluctuation Downstream of Englebright Dam[38]

With the exception of emergencies, releases required by U.S. Army Corps of Engineers flood control criteria, releases required to maintain a flood control buffer or for other flood control purposes, bypasses of uncontrolled flows into Englebright Reservoir, uncontrolled spilling, or uncontrolled flows of tributary streams downstream of Englebright Dam, Licensee shall make reasonable efforts to operate New Bullards Bar Reservoir and Englebright Reservoir to avoid fluctuations in the flow of the lower Yuba River downstream of Englebright Dam, and daily changes in project operations affecting releases or bypasses of flow from Englebright Dam shall be continuously measured at the USGS gage at Smartsville, and shall be made in accordance with the following conditions:

i. Project releases or bypasses that increase streamflow downstream of Englebright Dam shall not exceed a rate of change of more than 500 cfs per hour.

ii. Project releases or bypasses that reduce streamflow downstream of Englebright Dam shall be gradual and, over the course of any 24-hour period, shall not be reduced below 70 percent of the prior day's average flow release or bypass flow.

iii. Once the daily project release or bypass level is achieved, fluctuations in the streamflow level downstream of Englebright Dam due to changes in project operations shall not vary up or down by more than 15 percent of the average daily flow.

iv. During the period from September 15 to October 31, the licensee shall not reduce the flow downstream of Englebright Dam to less than 55 percent of the maximum five-day average release or bypass level that has occurred during that September 15 to October 31 period or the minimum streamflow requirement that would otherwise apply, whichever is greater.

v. During the period from November 1 to March 31, the licensee shall not reduce the flow downstream of Englebright Dam to less than the minimum streamflow release or bypass established under (iv) above; or 65 percent of the maximum five-day average flow release or bypass that has occurred during that November 1 to March 31 period; or the minimum streamflow requirement that would otherwise apply, whichever is greater.

[38] This proposed condition is identical to Article 33(d), footnote 3B in the existing license, as amended by FERC's November 22, 2005 Order Modifying and Approving Amendment of License.

7.0 Recreation Resources

7.1 YCWA's Proposed Condition RR1: Implement Recreation Facilities Management Plan[39, 40]

Licensee shall, within the first year of the new license term, implement the Recreation Facilities Management Plan included in Licensee's application for new license, as approved by the Commission.

7.2 YCWA's Proposed Condition RR2: Provide Recreation Flow Information

Licensee shall, within the first year of license issuance, make the following information available to the public on a real-time basis via the Internet, which may be accomplished through a third party, which may be the California Date Exchange Center:

- Reservoir Storage (end-of-day reservoir water surface elevation in feet)
  - New Bullards Bar Reservoir
- Streamflow (hourly data in cubic feet per second, or cfs)
  - Middle Yuba River downstream of Our House Diversion Dam
  - Oregon Creek downstream of Log Cabin Diversion Dam
  - North Yuba River downstream of New Bullards Bar Dam (when dam is not spilling)
  - Yuba River at Smartsville
  - Yuba River at Marysville
- Streamflow (mean daily flow in cfs)
  - North Yuba River downstream of New Bullards Bar Dam (when dam is spilling)

It is understood this information will be provisional and subject to change because it will not have undergone a quality assurance or quality control review before it is made available to the public.

Where existing streamflow gages do not measure a full range of flows and the streamflow is outside the measurement range, then Licensee shall make a good faith effort to estimate the flow.

[39] This plan is included in Appendix E3 of Exhibit E of Application for New License.
[40] This condition overlaps in part with Articles 17 and 18 in FERC's Form-L5 Standard Articles.

8.0 Land Use

8.1 YCWA's Proposed Condition LU1: Implement Transportation System Management Plan[41]

Licensee shall, within the first year of the new license term, implement the Transportation System Management Plan included in Licensee's application for new license, as approved by the Commission.

8.2 YCWA's Proposed Condition LU2: Implement Fire Prevention and Response Plan[42, 43]

Licensee shall, within the first year of the new license term, implement the Fire Prevention and Response Plan included in Licensee's application for new license, as approved by the Commission.

9.0 Cultural Resources

9.1 YCWA's Proposed Condition CR1: Implement Historic Properties Management Plan[44]

Licensee shall, in the first year of new license term, implement the Historic Properties Management Plan included in Licensee's application for new license, as approved by the Commission.

10.0 Aesthetic Resources

10.1 YCWA's Proposed Condition VR1: Implement Visual Resources Management Plan[45]

Licensee shall, within the first year of the new license term, implement the Visual Resources Management Plan included in Licensee's application for new license, as approved by the Commission.

[41] This plan is included in Appendix E3 of Exhibit E of Application for New License.
[42] This plan is included in Appendix E3 of Exhibit E of Application for New License.
[43] This condition overlaps in part with Article 28 in FERC's Form-L5 Standard Articles.
[44] This plan is included in Volume IV of Application for New License, and is considered Privileged.
[45] This plan is included in Appendix E3 of Exhibit E of Application for New License.

11.0 Socioeconomic Resources

YCWA's proposed Project does not include conditions specifically related to socioeconomic resources.

12.0 Air Quality

YCWA's proposed Project does not include conditions specifically related to air resources.

13.0 Noise

YCWA's proposed Project does not include conditions specifically related to noise.