ENVIRONMENTAL ANALYSIS

for the

PROPOSED TEMPORARY TRANSFER OF WATER FROM THE YUBA COUNTY WATER AGENCY YUBA RIVER DEVELOPMENT PROJECT TO THE CALIFORNIA DEPARTMENT OF WATER RESOURCES CALFED ENVIRONMENTAL WATER ACCOUNT PROJECT/ 2005 DRY YEAR WATER PURCHASE PROGRAM

Prepared for

Yuba County Water Agency

Department of Water Resources, State of California

California Environmental Protection Agency
STATE WATER RESOURCES CONTROL BOARD

Prepared by

SWRI Surface Water Resources, Inc.

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PROPOSED 2005 TEMPORARY TRANSFER OF WATER FROM YUBA COUNTY WATER AGENCY TO CALIFORNIA DEPARTMENT OF WATER RESOURCES

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Basin Plan	Central Valley Regional Water Quality Control Plan
Bay-Delta	San Francisco Bay/Sacramento-San Joaquin Delta Estuary
BVID	Browns Valley Irrigation District
CALFED	CALFED Bay-Delta Program
CCR	California Code of Regulations
CCWD	Contra Costa Water District
CDEC	California Data Exchange Center
CDFG	California Department of Fish and Game
CDPR	California Department of Parks and Recreation
CEQA	California Environmental Quality Act
cfs	cubic feet per second
COA	Coordinated Operations Agreement
Corps	U.S. Army Corps of Engineers
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
D-1641	SWRCB Decision 1641
Delta	Sacramento-San Joaquin Delta
DWR	California Department of Water Resources
EC	electrical conductivity
ESA	Endangered Species Act
ESU	evolutionarily significant unit
EWA	Environmental Water Account
FERC	Federal Energy Regulatory Commission
Groundwater Program	Groundwater Monitoring and Reporting Program
Interior	U.S. Department of Interior
JSA	Jones & Stokes Associates
NGOs	non-governmental organizations
NMFS	National Oceanic and Atmospheric Administration, National Marine Fisheries Service
MWH	Montgomery Watson Harza Americas, Inc.
ODEQ	Oregon Department of Environmental Quality
PCWA	Placer County Water Agency
PG&E	Pacific Gas and Electric Company
Reclamation	U.S. Bureau of Reclamation
RD-1644	State Water Resources Control Board Revised Water Right Decision 1644
Refill Agreement	New Bullards Bar Reservoir Refilling Conditions and Procedures for Water Transfer from Yuba to the Department

RM	River Mile
RWQCB	Regional Water Quality Control Board
SAFCA	Sacramento Area Flood Control Agency
SCVWD	Santa Clara Valley Water District
RST	rotary screw trap
SRA	State Recreation Area
SWP	State Water Project
SWRCB	State Water Resources Control Board
SWRI	Surface Water Resources, Inc.
TDS	total dissolved solids
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
VAKI	VAKI RiverWatch system
YOY	young-of-the-year
YCWA	Yuba County Water Agency
Yuba Project	Yuba River Development Project

PROPOSED 2005 TEMPORARY TRANSFER OF WATER FROM YUBA COUNTY WATER AGENCY TO CALIFORNIA DEPARTMENT OF WATER RESOURCES

1.0 INTRODUCTION

Temporary water transfers have been advocated as a critically important mechanism to distribute water throughout California. For example, the CALFED San Francisco Bay/Sacramento-San Joaquin Delta estuary (Bay-Delta) Program (CALFED) identified water transfers as a key component of a long-term comprehensive plan to restore the ecological health and improve water management for beneficial uses of the Bay-Delta (CALFED Final Programmatic Environmental Impact Statement/Environmental Impact Report Record of Decision, August 28, 2000). Over the past 16 years, the Yuba County Water Agency (YCWA) has conducted several water transfers from the Yuba River to the California Department of Water Resources (DWR) and other water agencies to enhance water supply reliability, protect water quality in the Delta (i.e., salinity control), and improve environmental conditions.

YCWA proposes to transfer up to 125,000 acre-feet of water to DWR in 2005 although, depending upon hydrologic conditions and DWR water needs, YCWA may transfer a minimum of 62,000 acre-feet of water. This Environmental Analysis considers the potential for effects on fish, wildlife and other instream uses under these two transfer scenarios to bracket the range of conditions that could occur in 2005: (1) a maximum transfer scenario (125,000 acre-feet); and (2) a minimum transfer scenario (62,000 acre-feet). Additionally, because the water year type remains uncertain at this time, and the minimum instream flow requirements of the State Water Resources Control Board (SWRCB) Revised Water Right Decision 1644 (RD-1644) interim flows vary significantly between the Dry Year requirements and the Below Normal/Above Normal Year requirements, the analysis considers the potential hydrologic conditions that could occur for each transfer scenario and under each water year type (Dry and Below Normal). These scenarios are described in the *Hydrologic Analysis of the Yuba County Water Agency 2005 EWA/DWR Transfer (Montgomery Watson Harza [MWH] Americas, Inc.)* (**Appendix A**).

The proposed transfer would occur with the release of stored water from New Bullards Bar Reservoir or from the substitution of groundwater for surface water deliveries involving YCWA member units (water agencies and irrigation districts), or a combination of the two. YCWA would release the water from the Yuba River Development Project (Yuba Project) facilities and transfer the water to DWR via the lower Yuba River, lower Feather River, Sacramento River, and the Sacramento-San Joaquin Delta (Delta). Water reaching the Delta would be available for use by DWR for use in the CALFED Environmental Water Account (EWA) and/or the 2005 Dry Year Water Purchase Program, to provide salinity and water quality controls within the Delta, or may be exported to users within the State Water Project (SWP) or Central Valley Project (CVP) service areas. Water exported from the Delta would be pumped to SWP or CVP contractors via the SWP Harvey O. Banks Pumping Plant or CVP Tracy Pumping Plant, both located in the southern Delta.

DWR has preliminarily indicated it would purchase a minimum of 62,000 acre-feet of water for use in the 2005 EWA, with an option to purchase up to an additional 63,000 acre-feet of water, depending upon the EWA, Dry Year Water Purchase Program, or SWP/CVP contractor needs for 2005. Generally, the proposed 2005 temporary water transfer would be conducted in a manner similar to water transfers completed in 2002, 2003, and 2004, including coordination with DWR and fisheries resources agencies to avoid unreasonable impacts upon fish, wildlife, and other beneficial uses. This Environmental Analysis presents the assessment required by California Water Code §1727 regarding the potential for unreasonable impacts upon fish, wildlife, or other instream beneficial uses and upon any legal user of the water.

YCWA is requesting SWRCB approval of a temporary change in water rights petition involving the transfer of water to DWR between mid-June or July 1, through October 2005. Sources of water for the transfer potentially would include: (1) stored water from New Bullards Bar Reservoir; and/or (2) surface water made available through an increase in groundwater pumping (groundwater substitution) by YCWA member units. The stored reservoir water would otherwise remain in surface storage at New Bullards Bar Reservoir (Water Code §1725). Surface water made available for groundwater substitution requires YCWA's member units agreeing to use and pump groundwater rather than divert surface water flows from the lower Yuba River or receive surface water diversion allocations from YCWA. Member units participating in groundwater substitution practices are anticipated to include Brophy Water District, Browns Valley Irrigation District, Cordua Irrigation District, Dry Creek Mutual Water Company, Hallwood Irrigation Company, Ramirez Water District and South Yuba Water District.

The amount of water to be obtained and transferred from either stored reservoir water or through groundwater substitution has not yet been determined. The decisions regarding the ultimate source and amount of water for the transfer partly would depend upon prevailing hydrologic conditions (Appendix A). YCWA has the ability to transfer up to 100,000 acre-feet of stored reservoir water and obtain up to 85,000 acre-feet of water through groundwater substitution. Regardless of the source, the final total water transfer for 2005 would not exceed 125,000 acre-feet and the minimum transfer amount would be 62,000 acre-feet.

1.1 PROJECT LOCATION, AGENCIES, AND RELATED FACILITIES

1.1.1 YUBA COUNTY WATER AGENCY AND YUBA RIVER DEVELOPMENT PROJECT

YCWA is a public agency created and existing pursuant to the provisions of the YCWA Act (California Statutes 1959, Chapter 2788, as amended). YCWA owns the Yuba Project, which is a multi-purpose project and includes features utilized for water supply, irrigation, flood control, hydropower generation, fisheries protection and enhancement, and recreational activities. Yuba Project features are located on the Middle Yuba River, North Yuba River, and on Oregon Creek, a tributary to the Middle Yuba River. Principle facilities include: Our House Diversion Dam on the Middle Yuba River; Lohman Ridge Tunnel between the Middle Yuba River and Oregon Creek; Log Cabin Diversion Dam on Oregon Creek; Camptonville Tunnel between Oregon Creek and New Bullards Bar Reservoir; New Bullards Bar Dam, Reservoir and Fish Release Power facility on the North Yuba River; New Colgate Powerhouse below New Bullards Bar Dam on the Yuba River; and Narrows II Powerhouse just below Englebright Dam and Reservoir on the lower Yuba River. The Yuba Project operations are coordinated with the U.S. Army Corps of Engineers (Corps) and Pacific Gas and Electric Company (PG&E) operation of Englebright Reservoir and Dam and the Narrows I Powerhouse structures on the lower Yuba River. The location of the Yuba Project features are shown on **Figure 1.**

1.1.2 CALIFORNIA DEPARTMENT OF WATER RESOURCES STATE WATER PROJECT

The SWP includes 29 storage facilities, 18 pumping plants, four pumping-generating plants, five hydroelectric power plants, and approximately 660 miles of canals and pipelines. Its main purpose is water supply; that is, to divert and store surplus water during wet periods and distribute it to areas of need in northern California, the San Francisco Bay area, the San Joaquin Valley, the Central Coast, and southern California. Other SWP purposes include flood control, power generation, recreation, fish and wildlife enhancement, and water quality improvements in the Delta. Twenty-nine urban and agricultural water agencies have long-term contracts for an ultimate total of just over 4 million acre-feet per year of water from SWP. DWR operates the SWP to balance its many competing objectives.

1.1.3 U.S. BUREAU OF RECLAMATION CENTRAL VALLEY PROJECT

The CVP is a multi-purpose project operated by the U.S. Bureau of Reclamation (Reclamation) that stores and transfers water from the Sacramento, San Joaquin, and Trinity river basins to the Sacramento and San Joaquin valleys. Congress authorized the CVP in 1937 for water supply, hydropower generation, flood control, navigation, fish and wildlife, recreation, and water quality control purposes. The CVP service area extends about 430 miles through much of California's Central Valley, from Trinity and Shasta reservoirs in the north to Bakersfield in the south.

1.2 PURPOSE AND NEED FOR 2005 WATER TRANSFER

DWR is a CALFED Project Agency and together with Reclamation, is responsible for administering the CALFED EWA, including banking, borrowing, transferring, selling and arranging for the conveyance of EWA water supply or EWA assets. DWR and Reclamation are responsible for seeking to acquire approximately 200,000 acre-feet of water on behalf of the EWA annually. YCWA's proposed 2005 water transfer would assist DWR in meeting a substantial portion of the EWA asset acquisition for 2005. DWR also acquires water for its annual Dry Year Water Purchase Program for use in the SWP and CVP service areas. If a portion of the YCWA transfer water is not needed for the EWA, DWR may elect to use the water for the 2005 Dry Year Water Purchase Program. These programs are described in the following sections.

1.2.1 CALFED ENVIRONMENTAL WATER ACCOUNT

The EWA is one of the components identified in the CALFED Bay-Delta Program to implement a long-term comprehensive plan to restore the ecological health and improve water management for beneficial uses of the Bay-Delta estuary (CALFED Final PEIS/EIR July 2000). CALFED's goal is to concurrently and comprehensively address problems of the Bay-Delta system within each of four resource categories: (1) ecosystem quality; (2) water quality; (3) water supply reliability; and (4) levee system integrity.

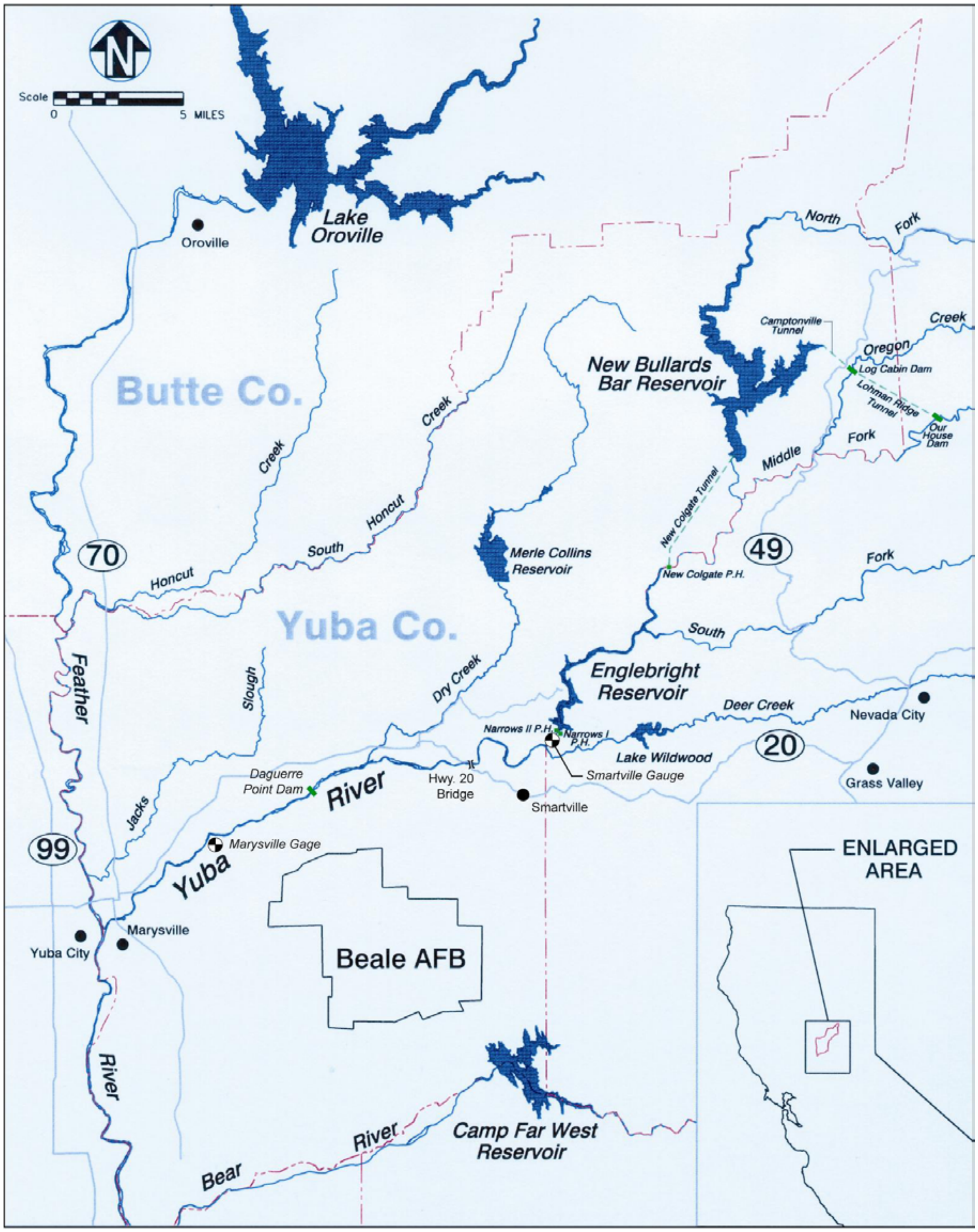

Figure 1. Location of Yuba River Development Project facilities.

The CALFED Bay-Delta Program Programmatic ROD (August 2000) for the Final PEIS/EIR also specifically identifies a need for fisheries protection measures, in addition to baseline regulatory measures, to speed recovery of listed fish species.

The EWA incorporates environmentally beneficial changes to the operation of the SWP and the CVP, at no water cost to the SWP/CVP water users. This approach to fish protection requires the acquisition of alternative sources of SWP/CVP water supply, called "EWA assets" which are used to: (1) augment streamflows and Delta outflows; (2) modify Delta exports to protect sensitive fish species in the Delta during critical life history periods; and (3) compensate for reductions in deliveries of SWP/CVP water supplies interrupted due to changes to SWP/CVP operations. Because of the extremely flexible nature of the EWA, water transferred to DWR that becomes part of the EWA can be used for a variety of purposes to enhance fisheries and water supply conditions.

The EWA Management Agencies (California Department of Fish and Game [CDFG], National Marine Fisheries Service [NMFS], and U.S. Fish and Wildlife Service [USFWS[) have primary responsibility for managing the EWA assets and exercising their biological judgment to determine what SWP/CVP operational changes are beneficial to the Bay-Delta ecosystem and/or the long-term survival of fish species, including those listed under the federal and state Endangered Species Acts (ESA). The EWA Project Agencies (DWR and Reclamation) cooperate with the Management Agencies in the administration of the EWA, including banking, borrowing, transferring, selling, and arranging for the conveyance of EWA assets. The Project Agencies implement the operational changes proposed by the Management Agencies, when possible and feasible.

The EWA initially was established as a four-year program to test its viability. Over those years the EWA agencies developed EWA into a flexible water and fisheries resources management tool toward achievement of the EWA objectives. In September 2004, the EWA agencies extended the existing EWA program for an additional three years (through 2007).

1.2.2 California Department of Water Resources - 2005 Dry Year Water Purchase Program

DWR's Dry Year Water Purchase Program allows agencies to participate in direct purchase of water provided by willing sellers through DWR. DWR acquires water from willing sellers in northern California and provides it to water agencies throughout the state to help offset water shortage conditions. The program is intended to reduce the possibility of adverse economic impacts and hardship associated with water shortages, and is open to all agencies in the state. By purchasing water from YCWA and other willing sellers to meet requests for water supplies through the Dry Year Water Purchase Program, DWR can assist other agencies throughout California meet water supply needs for a number of uses including irrigation, domestic use, industrial use, recreation, fish mitigation and enhancement, municipal use, salinity control, and water quality control (EDAW 2004).

During the years 2001 through 2004, some areas of California experienced water deficiencies. DWR responded by implementing Dry Water Year Purchase programs in each of these years. In 2001, DWR secured 138,800 acre-feet of water from willing sellers in northern California and provided it to eight water agencies throughout California to help offset their water shortage conditions. In 2002, DWR secured 22,000 acre-feet of water from willing sellers in northern California and provided it to four water agencies throughout California (EDAW 2004).

On August 13, 2004, DWR announced that it was initiating a 2005 Dry Year Water Purchase Program allowing water agencies to enter the program in the fall and request that DWR obtain options to lease water for 2005 to be used if the dry conditions persist. *(Department of Water Resources California Water Page "News for Immediate Release" dated August 13, 2004. www.water.ca.gov/newsreleases/2004/08-13-04dryyear.cfm. Web page accessed Tuesday, January 11, 2005; and Water Strategist, Analysis of Water Marketing, Finance, Legislation and Litigation; Editor Rodney T. Smith, Publisher: Lisa Hahn. Copyright 2004 by Stratecon, Inc. PO Box 963 Claremont CA 91711; www.waterstrategist.com September 2004 issue. Web page accessed Tuesday, January 11, 2005.)*

1.3 PURPOSE OF THIS ENVIRONMENTAL ANALYSIS

This Environmental Analysis describes the results of the environmental impact assessment conducted to determine whether the proposed 2005 temporary water transfer from YCWA to DWR would result in any unreasonable impact on fish, wildlife, or other instream beneficial uses, in accordance with Water Code §1727. The following sections provide information related to YCWA's petition to the SWRCB regarding temporary changes to YCWA's water right permits to implement the proposed water transfer, the SWRCB's statutory provisions under the California Water Code, and exemption of the proposed temporary transfer under the California Environmental Quality Act (CEQA) under Water Code §1729.

Guidance on the proper scope of environmental analysis necessary to comply with Water Code §1727 has been provided by past SWRCB orders associated with temporary water transfers. The following analysis has been prepared consistent with that guidance. Although this analysis is specific to the proposed 2005 water transfer, past water transfer analyses were reviewed and used as appropriate. Information presented in this document builds upon YCWA's environmental analyses of recent temporary water transfers (EDAW 2002, 2003, 2004).

1.3.1 PETITION TO STATE WATER RESOURCES CONTROL BOARD

On February 28, 2005, YCWA filed a petition with the SWRCB under the provisions of Water Code §1725 et. seq. and in conformance with the specific requirements of the California Code of Regulations (CCR) §794 for temporary changes to YCWA's water right permits to request approval of the proposed temporary water transfer from YCWA to DWR. The petition requests a change in the Point of Rediversion, Place of Use and Purpose of Use, as described below.

1.3.1.1 Change in Point of Rediversion

YCWA's petition includes the request of a change in point of rediversion from New Bullards Bar Reservoir (YCWA Permit No. 15026) for DWR to the Clifton Court Forebay (SWP facility) and the Tracy Pumping Plant (CVP facility). Additionally, the petition includes a request for point of rediversion for Ronald Conn and Lloyd and Gary Phelps delivery of up to 400 acre-feet for use on property on Roberts Island as described and authorized under water right license numbers 13315, 7609, 13274, and 13444, and involve diversion of water from the Delta.

1.3.1.2 Change in Place of Use

YCWA's petition includes a proposal and request to expand the place of use from the YCWA service area in Yuba County (YCWA Permit No. 15026) for DWR to include the SWP and CVP service areas in the California Central Valley: SWP (as shown on map 1878-1, 2, 3, and 4 on file with Application No. 5629); and CVP (as shown on map 214-208-12581 on file with Application No. 5626). Additionally, the petition will include a change in place of use for the transfer water provided by DWR to Conn and Phelps, the points of diversion authorized under water right license numbers 13315, 7609, 13274, and 13444.

1.3.1.3 Change in Purpose of Use

YCWA's petition includes a proposed change in purpose of use to include the present uses of irrigation, domestic, industrial, recreational, and fish mitigation and enhancement and request the additional uses of municipal supply, salinity control, and water quality control.

1.3.2 STATE WATER RESOURCES CONTROL BOARD'S STATUTORY PROVISIONS

Pursuant to California Water Code §1725, et. seq., the SWRCB Division of Water Rights is authorized to issue temporary change orders, allowing the transfer or exchange of water or water rights after completing an evaluation sufficient to determine that the proposed temporary change(s):

- Involves only water that would otherwise have been consumptively used or stored by permittee or licensee;
- Would not injure any other legal user of the water; and
- Would not unreasonably affect fish, wildlife, or other instream beneficial uses.

This Environmental Analysis provides an evaluation of the potential impacts on fish, wildlife and other instream beneficial uses [Water Code §1727(b)(2)].

1.3.3 CALIFORNIA ENVIRONMENTAL QUALITY ACT COMPLIANCE

CEQA California Public Resources Code §21000 et. seq., requires that prior to deciding to implement a project, environmental effects of the project must be described and appropriately addressed. However, as described in CCR §15282 (v), and Water Code §1729, temporary water transfers of up to one year in duration are statutorily exempt from CEQA. The description of the proposed 2005 temporary water transfer discusses actions to be taken by YCWA and DWR related to a temporary water transfer for a duration of less than one year. Therefore, the proposed project meets the requirements and definitions of the CCR and Water Code, and is statutorily exempt.

2.0 DESCRIPTION OF 2005 WATER TRANSFER

YCWA has completed a number of water transfers in recent years to enhance statewide water supply, water quality, and environmental conditions. Water transfers in 2001 through 2004 were to DWR for the EWA, in 2002 and 2004 transfers were made to the DWR Dry Year Water Purchase Program, and in 2002, 2003, and 2004, transfers were made to Contra Costa Water District (CCWD). YCWA's policy for water transfers is to determine annually if hydrologic and hydrogeologic conditions provide for water, under YCWA water rights, that is surplus to the needs of its customers and Yuba County demands. If YCWA determines that water may be available in a given year for transfer, it then works with parties, including DWR, to determine if there is an interest in transfer of water from the Yuba River, consistent with California policy as set forth in Water Code §109 and §475. Delivery of the water to a willing buyer is conducted in a manner that satisfies California Water Code §1725 et. seq. Transfers typically involve both water that would otherwise remain in surface storage at New Bullards Bar Reservoir and water provided through groundwater substitution.

Water transfers from YCWA do not involve transferring a water right permit or license or rights thereto and receiving payment for that right. The current petition to the SWRCB is for the temporary change in place of use, point of rediversion, and purpose of use of YCWA rights to facilitate the transfer of water through the re-operation of YCWA facilities. All releases are subject to the prior right to the use of the water by or for the member units of YCWA. No releases of water pursuant to the agreements between YCWA and DWR confer any appropriative, public trust, or other right to water on any person or entity.

YCWA agrees to temporarily revise its plan of operation (storage and water release) of its Yuba Project facilities including New Bullards Bar Reservoir on the North Yuba River, in exchange for compensation, to provide water for DWR acquisition in 2005. YCWA will release water from New Bullards Bar Reservoir into the lower Yuba River, exclusively during balanced Delta conditions[1] from mid-June or July 1 through September 2005 for recovery *via* SWP and CVP pumps. Additionally, water will be released from New Bullards Bar Reservoir for the Browns Valley Irrigation District transfer of 3,100 acre-feet of water to the Santa Clara Valley Water District during the first two weeks of October 2005. Water transfer flows will pass-through Englebright Reservoir and Dam and Daguerre Point Dam. New Bullards Bar Reservoir storage levels during the transfer will remain within normal operating limits for the Yuba Project. YCWA will release the excess stored water plus lower Yuba River basin runoff for the water transfer period. YCWA will not change its historical irrigation practices and will meet minimum instream flow requirements (e.g., fish releases) below its dams as required by SWRCB RD-1644 and Federal Energy Regulatory Commission (FERC) License 2246. The YCWA releases will flow from the Yuba River into the Feather River, Sacramento River, and downstream to the Delta. The transfer water would be used for environmental purposes in the Delta or conveyed at the pumping plants at Clifton Court Forebay into conveyance channels, and either stored in San Luis Reservoir or transported through the California Aqueduct directly to groundwater storage banks, or CVP or SWP contractors, including Conn and Phelps for diversion from the Delta.

[1] Balanced conditions exist when DWR and Reclamation agree that releases from upstream reservoirs plus unregulated flow approximately equal the water supply needed to meet Sacramento Valley in-basin uses, Delta water quality and outflow requirements, and Delta exports.

YCWA has agreed with DWR to implement a refill agreement ("New Bullards Bar Reservoir Refilling Conditions and Procedures for Water Transfer from Yuba to the Department") with specific special reservoir refilling conditions and procedures for the water transfer to determine and compensate for any refill effects to the SWP and CVP due to refilling of New Bullards Bar Reservoir, as has been done in past water transfer years. Repayment of water for a refill impact under the provisions of the agreement with DWR calls for the release of water in a subsequent period during balanced Delta conditions with credit to either the SWP or CVP, as appropriate. This refill agreement was an attachment to YCWA's February 28, 2005 temporary water transfer petition to the SWRCB.

YCWA proposes to transfer a minimum of 62,000 acre-feet and up to a maximum of 125,000 acre-feet of water in 2005 depending upon hydrologic conditions and DWR demands for transfer water. YCWA plans to transfer at least 62,000 acre-feet of this water to DWR for the CALFED EWA, and the balance to DWR either for additional EWA benefit, for use in DWR's 2005 Dry Year Water Purchase Program, or to meet other SWP and CVP water needs including provision of up to 400 acre-feet of transfer water to Conn and Phelps for diversion from the Delta. The water transfer is planned to occur between mid-June or July 1 through September 2005, with most of the water to be transferred during July and August 2005. Additionally, releases would be made from New Bullards Bar Reservoir for the Browns Valley Irrigation District (BVID) transfer of 3,100 acre-feet of water to the Santa Clara Valley Water District (SCVWD) for the period of October 1 through October 15, 2005. A portion of the water transfer would be obtained from stored water from New Bullards Bar Reservoir (up to 100,000 acre-feet) and a portion may be derived through groundwater substitution (up to 85,000 acre-feet). Groundwater substitution involves voluntary participation of YCWA member units electing to pump groundwater *in lieu* of receiving surface water deliveries from YCWA, or instead of diverting directly from the Yuba River. YCWA would enter into agreements with entities agreeing to participate in groundwater substitution practices for the 2005 water transfer period. The specific proportion of transfer water from each source is determined annually based on hydrologic and hydrogeologic conditions. Participation in transfers to DWR or others is a year-by-year occurrence, and therefore, satisfies the conditions of a temporary change under Water Code §1728. On March 4, 2005, YCWA submitted to the SWRCB a report prepared by MWH on hydrologeologic conditions respecting YCWA's 2005 groundwater substitution program in support of YCWA's February 28, 2005 temporary water petition. This MWH report concludes that the proposed groundwater substitution component of the proposed water transfer would not result in any significant negative unmitigated Yuba groundwater sub-basin impacts or third-party impacts with Yuba County or surrounding areas.

Hydrologic changes that would be anticipated under the proposed water transfer scenarios are described in Appendix A. The hydrologic evaluation provides the best estimate at this time of the timing and conditions that would be associated with the proposed transfer under the maximum and minimum water transfer scenarios and according to possible water year types (i.e., "Dry Water Year" or "Below Normal Water Year"). The hydrologic study describes the potential effects of the proposed transfer on Yuba River flows, New Bullards Bar Reservoir storage, and Feather River flows. Figures included in Appendix A provide detailed modeling output under the scenarios described above to bracket the potential hydrologic changes associated with the proposed water transfer.

The environmental analysis evaluates the proposed temporary water transfer scenarios for both Dry and Below Normal water year types and discusses the potential hydrologic changes associated with these scenarios and the resulting potential effects on the environment. The timing and quantity of water ultimately released for the transfer will depend on a variety of factors including: (1) the rate at which DWR (or the SWP/CVP system/contractors) can pump water from the Delta; (2) the rate at which Yuba River fisheries impacts are minimized and benefits to the fishery can be provided; (3) hydrologic conditions; and (4) other operational constraints.

YCWA also will pursue agreements with water districts and water companies within the YCWA service area to implement the groundwater substitution component of the proposed water transfer. Potential effects of the groundwater substitution component of the proposed 2005 water transfer are examined in the *Analysis of the Groundwater Substitution Portion of the Yuba County Water Agency-CALFED Environmental Water Account/Department of Water Resources and State Water Contractor 2005 Transfer* (Groundwater Analysis) submitted to the SWRCB under separate cover. The Groundwater Analysis provides a detailed description of the Yuba Groundwater sub-basin, groundwater occurrence and development, and groundwater storage conditions. The evaluation provides the best estimate at this time of the type and potential for third-party impacts in the sub-basin. Further, YCWA, in cooperation with DWR, will implement a Groundwater Monitoring and Reporting Program. Additional discussion of the Groundwater Monitoring and Reporting Program (Groundwater Program) is provided in Section 4.3.3, Groundwater Resources. The detailed Groundwater Program is included as an exhibit to the 2005 Water Transfer Agreement between YCWA and DWR.

2.1 RIVER FLOW SCHEDULE

The following sections describe the projected "without-transfer" flows and the "with-transfer" flows for potentially affected water bodies including the Yuba River, Feather River, and Sacramento River and are based upon the information provided in the Hydrologic Analysis (Appendix A).

2.1.1 WITHOUT-TRANSFER FLOWS

2.1.1.1 Yuba River

Yuba River flows are measured at Smartville near Englebright Reservoir at the upper end of the lower Yuba River (Smartville Gage – USGS Station No. 11418000) and at Marysville, about 6 miles upstream of the mouth of the Yuba River (Marysville Gage - USGS Station No. 11421500).

The Yuba River's hydrology is highly variable. The Hydrologic Analysis (Appendix A) provides figures representing projected Yuba River flows from May through October above Daguerre Point Dam (Smartville Gage) and below Daguerre Point Dam (Marysville Gage) for "Below Normal" and "Dry" water year types (and specific instream flow requirements) for both the maximum and minimum water transfer scenarios. In each scenario, the without-transfer flows between Englebright Reservoir and Daguerre Point Dam (Smartville Gage) consist of required instream flows plus forecasted releases to meet agricultural diversion requirements. Below Daguerre Point Dam (Marysville Gage), the without-transfer flows consist only of the required minimum instream flows (Appendix A).

Groundwater substitution transfer flows are not shown in the figures as a separate flow. If a portion of the transfer were to be acquired from groundwater substitution, the resulting overall flows would be identical to those shown in each of the figures, except that the diversion delivery amounts shown for the Smartville Gage representations would be reduced by the amount of the groundwater substitution (Appendix A).

Below Normal Water Year

Below Normal water year instream flow requirements are depicted on Figures 1, 2, 5 and 6 in Appendix A. These flow levels represent the minimum flows projected for the without-transfer condition under Below Normal water year requirements. As depicted in these figures, minimum without-transfer flows on the Yuba River would be approximately 800 cfs in June, ramp down to approximately 550 cfs on or about July 1, 2005, with incremental decreases for the first few days in July and level off at around 250 cfs for most of July through September 30, flows would then increase to 450 cfs for the first two weeks of October and up to 500 cfs for the remainder of October. Figures 1 and 5 depict the forecasted diversion requirements that would be released and projected flow between Englebright Reservoir and Daguerre Point Dam, in addition to the minimum instream flow requirements, for the minimum and maximum transfer scenarios, respectively.

Dry Water Year

Dry water year instream flow requirements are depicted on Figures 3, 4, 7 and 8 in Appendix A. These flow levels represent the minimum flows projected for the without-transfer condition under Dry water year requirements. As depicted in these figures, minimum without-transfer flows on the Yuba River would be approximately 400 cfs through June, ramp down to approximately 300 cfs on or about July 1, 2005, with another incremental decrease to 250 cfs on or about July 2, 2005 at which level minimum flow requirements would remain for the remainder of July through about October 15, 2005, at which time flows would then increase to 400 cfs for the remainder of October. Figures 3 and 7 indicate the forecasted diversion requirements that would be released and projected flow between Englebright Reservoir and Daguerre Point Dam, in addition to the minimum instream flow requirements, for the minimum and maximum transfer scenarios, respectively.

Anticipated Lower Yuba River Flows for 2005

The 2005 water year to date (February 2005) has been somewhat above average for precipitation, and so the water year could result in a moderate range of hydrologic conditions. At present, it is expected that Yuba River flows during June through October, without the transfer, would be somewhat above the minimum flows required by RD-1644, as described above and represented on the figures in Appendix A. The Hydrologic Analysis (Appendix A) is based on an assumption that the without-transfer flows in the Yuba River would be at the minimum instream flows, plus local deliveries (above Daguerre Point Dam), resulting in the lowest possible representation of flow conditions for the lower Yuba River for the June through October period. Given present conditions and projections of runoff, there is reasonable probability that this would occur (Appendix A). Uncontrolled spring snowmelt flows, if they were to occur, most likely would reach the river in May and June, prior to the start of the transfer, and would not be influenced by the transfer (i.e., flows in these months would be the same with or without the transfer) (Appendix A).

2.1.1.2 Feather River

Although hydrologic conditions could change, flows in the Feather River during summer 2005 are expected to be similar to flows that occurred during the summers of 2003 and 2004 (Appendix A). Additionally, anticipated without-transfer flows on the Feather River below the Yuba River are expected to be about four to five times greater than Yuba River flows.

Feather River flows are controlled primarily by DWR's operation of the Oroville Facilities including the release of flows from Oroville, coordinated with Reclamation's release of flows from Shasta Reservoir to meet water supply and environmental needs downstream. A minimum flow of 600 cfs is maintained in the 8-mile low-flow channel of the Feather River between the Fish Barrier Dam and the river outlet from the Thermalito Afterbay. A minimum flow of approximately 1,700 cfs is maintained in the 59-mile high-flow section of the Feather River below the Thermalito Afterbay river outlet. Average flows in the Feather River during July and August are 7,600 cfs during wet years, 5,750 cfs during above normal years, 4,700 cfs during below normal years, 4,050 cfs during dry years, and 2,950 cfs during critically dry years (YCWA 1998 *as cited in* EDAW 2004).

2.1.1.3 Sacramento River

Sacramento River flows are controlled primarily by Reclamation's operation of Shasta Dam. As indicated above, release flows from both Oroville and Shasta dams are coordinated by DWR and Reclamation, respectively to meet water supply and environmental needs downstream. Available average daily flow records for the Sacramento River recorded at the Freeport gaging station (FPT) were obtained from the DWR California Data Exchange Center (CDEC) website (*http://cdec.water.ca.gov*) (as reported in PCWA 2003). Mean monthly flows for the Sacramento River at Freeport during the June through October period (1965 through 2001) range from an average of 12,499 cfs in October to an average of 16,892 cfs in June (**Table 1**). These values generally are consistent with the reported estimated average without-transfer flows on the Sacramento River at Freeport at or above 15,000 cfs for the June through September period, as reported in EDAW 2004.

Table 1. Minimum, maximum, and mean monthly flow (cfs) for the Sacramento River at Freeport during the June through October period (1965 through 2001).

Monthly Flows (cfs)	June	July	August	September	October
Minimum	8,201	8,071	7,473	5,441	5,234
Mean	16,892	16,776	16,479	14,917	12,499
Maximum	39,443	24,757	26,843	24,914	23,257

Source: CDEC 2003 *as reported in* PCWA 2003

2.1.2 PROPOSED 2005 TRANSFER FLOWS

The proposed 2005 transfer of up to 125,000 acre-feet of water to DWR is expected to take place primarily during July through September 2005. Additionally, as depicted in the Hydrologic Analysis, BVID plans to transfer 3,100 acre-feet of water to SCVWD during the first two weeks of October. Releases of water potentially could begin in mid-June 2005, particularly under the maximum transfer scenarios (Appendix A), but likely would begin by July 1, 2005. Transfer water release timing and volume would depend upon Delta pumping restrictions, presence of delta smelt, whether the Delta is in excess or balanced conditions, and whether unused export pumping capacity exists. The BVID transfer water would be accounted for in addition to the YCWA transfer water and minimum instream flow requirements, as measured at the Marysville gage.

2.1.2.1 Yuba River

Water that is released for use by DWR would be surplus to Yuba River instream flow requirements that are in effect during the transfer period. Minimum instream flow requirements for the Yuba River are based on FERC Narrows I and Narrows II hydroelectric project license requirements and prevailing interim instream flow requirements as established in the SWRCB's RD-1644 regarding the Yuba River (SWRCB 2003 *as cited in* EDAW 2004). Yuba River flows projected for the maximum and minimum water transfer scenarios for Below Normal and Dry water years are described below.

Maximum Water Transfer Scenario

The projected start date for the proposed water transfer, under the maximum transfer scenario, is June 15, 2005. However, as described previously, the start of transfer water delivery is affected by Delta conditions, therefore, deliveries may not begin until July 1, 2005. The analysis presented in the Hydrologic Analysis (Appendix A) represents the greatest potential flow changes due to the transfer by using a transfer start date of July 1 rather than June 15. YCWA will work with DWR and other EWA agencies to initiate the transfer as early as possible to lengthen the time frame for making the transfer and reducing the peak transfer flow, thereby providing a beneficial flow regime for lower Yuba River fisheries.

Below Normal Water Year

In a Below Normal water year, maximum water transfer flows will exceed the minimum instream flow requirement by about 970 cfs in July and early August and then will ramp down to approximately 250 cfs above the minimum instream flow requirement in September. The BVID water transfer to SCVWD would result in flows approximately 100 cfs above the minimum instream flow requirement for the first two weeks of October 2005. Figures 5 and 6 in Appendix A provide the maximum transfer flows with Below Normal water year requirements in the Yuba River above and below Daguerre Point Dam, respectively.

The flow schedule anticipated for the maximum transfer scenario under Below Normal water year conditions would result in a flow reduction followed by a flow increase during early June. The fluctuation results from the change in instream flow requirements (measured at the

Marysville Gage) from May to June – the May requirement is 1,500 cfs and the June requirement is 800 cfs. Additionally, because of potential limitations in the Delta, the start of the transfer potentially would not be until July 1. Once the transfer is initiated, the flow in the lower Yuba River will increase to about 1,220 cfs, an increase of 420 cfs. The increase in flow would be scheduled over a several days in increments of approximately 100 cfs (Appendix A). If Delta conditions allow for earlier release of the transfer water, the period of flow reduction in early June could be reduced and the subsequent overall transfer flow rate could be lower, reducing flow fluctuations during this period.

Dry Water Year

In a Dry water year, maximum water transfer flows will exceed the minimum instream flow requirement by about 1,023 cfs in July and early August and then will ramp down to approximately 150 cfs above the minimum instream flow requirement in September. The BVID water transfer to SCVWD also would result in flows approximately 150 cfs above the minimum instream flow requirement for the first two weeks of October 2005. Figures 7 and 8 in Appendix A provide the maximum transfer flows with Dry water year requirements in the Yuba River above and below Daguerre Point Dam, respectively.

This flow schedule is expected to result in a flow increase during early July. The flow increase would result due to the change from June instream flow requirements of 400 cfs and the start of the transfer in early July with flows of approximately 1,275 cfs. The projected flow increase of approximately 875 cfs would be performed incrementally over several days.

Minimum Water Transfer Scenario

The projected start date for the proposed water transfer, under the minimum transfer scenario, is July 1, 2005.

Below Normal Water Year

In a Below Normal water year, minimum water transfer flows will exceed the minimum instream flow requirement by about 400 cfs in July and August and approximately 250 cfs above the minimum instream flow requirement in September. The BVID water transfer to SCVWD would result in flows approximately 100 cfs above the minimum instream flow requirement for the first two weeks of October 2005. Figures 1 and 2 in Appendix A provide the maximum transfer flows with Below Normal water year requirements in the Yuba River above and below Daguerre Point Dam, respectively.

Dry Water Year

In a Dry water year, minimum water transfer flows will exceed the minimum instream flow requirement by about 450 cfs in July and August and approximately 150 cfs above the minimum instream flow requirement in September. The BVID water transfer to SCVWD would result in flows approximately 150 cfs above the minimum instream flow requirement for the first two weeks of October 2005. Figures 3 and 4 in Appendix A provide the maximum transfer flows with Dry water year requirements in the Yuba River above and below Daguerre Point Dam, respectively.

Yuba River Ramping Rates

YCWA will adhere to SWRCB conditions for ramping rates as expressed in RD-1644, which specifies that water releases (with or without-transfers) that increase streamflow downstream of Englebright Dam will not exceed a rate of change of more than 500 cfs per day. RD-1644 also specifies that flow reductions downstream of Englebright Dam will be gradual and, over the course of any 24-hour period, will not be reduced below 70 percent of the prior day's release flow.

2.1.2.2 Feather River

Flows in the Feather River would primarily be influenced by operation and management of the Oroville Facilities associated with coordinated and integrated SWP/CVP operations related to water supply and environmental requirements. Generally, average with-transfer flows in the Feather River below the Yuba River would not be expected to vary substantially from without-transfer flows (EDAW 2004). The greatest increase in flows due to the transfer alone would occur in the months of July and August, potentially between 1,023 cfs (maximum transfer, Dry water year) to 400 cfs (minimum transfer, Below Normal water year). Although the specific operational scenario associated with the proposed transfer is uncertain, it is anticipated that Feather River flows will remain within the normal flow ranges and fluctuations resulting from SWP operations.

2.1.2.3 Sacramento River

As stated earlier, flows in the Sacramento River primarily are influenced or controlled by Reclamation's operation of Shasta Dam and Reservoir as required for management of the CVP system, including coordinated operations with the SWP for water supply and environmental purposes. Flows in the lower Sacramento River potentially could increase by the same flow rates projected for the Yuba River and described above for the Feather River. Although the specific operational scenario associated with the proposed transfer is uncertain, projected Sacramento River flows are anticipated to remain within the normal flow ranges and fluctuations resulting from SWP and CVP operations.

2.1.3 RESERVOIR STORAGE CHANGES

2.1.3.1 New Bullards Bar and Englebright Reservoirs

YCWA will temporarily modify normal storage and water release operations from its Yuba Project facilities, including New Bullards Bar Reservoir on the North Yuba River, to provide water for DWR acquisition. Water transfer flows will pass-through Englebright Reservoir and Dam and Daguerre Point Dam. YCWA's operational target storage level for the end of September is 705,000 acre-feet for New Bullards Bar Reservoir under without-transfer conditions. YCWA operationally plans to reach carryover storage of 705,000 acre-feet in New Bullards Bar Reservoir at the end of September for each water year, unless runoff is insufficient to maintain this level and meet required instream flows and diversion demands. This storage amount is the target storage specified in YCWA's power purchase contract with PG&E for the Yuba Project. This storage target is above the level necessary for YCWA to ensure meeting required irrigation deliveries in 2006 because the YCWA service area is not fully developed and conjunctive use operations permit provision of groundwater supplies to meet irrigation demands in the event that surface water supplies are not available (Appendix A).

Under the proposed 2005 maximum water transfer scenario (regardless of water year type), YCWA will draw down New Bullards Bar Reservoir by up to 100,000 acre-feet by the end of the transfer period, resulting in reservoir storage of 605,000 acre-feet. Under the proposed 2005 minimum water transfer scenario (regardless of water year type), YCWA will draw down New Bullards Bar Reservoir by up to 62,000 acre-feet by the end of the transfer period, resulting in a reservoir storage of 643,000 acre-feet. The resultant potential storage levels anticipated for New Bullards Bar Reservoir under the "with proposed transfer scenarios" would be within normal historical operating parameters for the Yuba Project and would not go below minimum storage levels or water surface elevations for reservoir operations. The reduction of reservoir storage under the maximum transfer scenario of 100,000 acre-feet corresponds to a decrease in reservoir elevation of about 28 feet, from 1,896 feet above msl to approximately 1,868 feet above msl. Under the minimum transfer scenario of 62,000 acre-feet, New Bullards Bar Reservoir elevation would decrease by approximately 15 feet, from 1,896 feet above msl to approximately 1,881 feet above msl.

The water transfer amount would be limited such that the drawdown in New Bullards Bar Reservoir required for all releases would not reduce carryover storage below a level sufficient to meet local and instream requirements in 2005 and 2006 (see Appendix A for further discussion). Englebright Reservoir storage would remain relatively unaffected by the transfer and would remain within normal historical operation limits (EDAW 2004).

The up to 85,000 acre-feet potentially associated with groundwater substitution would be released with or without the proposed transfer, and therefore, would have no effect on New Bullards Bar Reservoir storage levels in 2005.

New Bullards Bar Reservoir Refill Conditions/Procedures

YCWA will refill New Bullards Bar Reservoir from Yuba River flows. The refill of released water will be made under a schedule mutually agreed upon by DWR and YCWA titled "*New Bullards Bar Reservoir Refilling Conditions and Procedures for Water Transfer from Yuba to the Department*" (Refill Agreement). The Refill Agreement is intended to ensure that future refill of water transferred from storage (i.e., the transfer total minus the total excess groundwater pumped) in New Bullards Bar Reservoir resulting in purchases of water from YCWA by DWR does not adversely impact the SWP or CVP. Based upon information from DWR and Reclamation, impacts on SWP or CVP potentially could occur if storage vacated by the transfer is refilled during balanced conditions in the Delta. Therefore, the procedures included in the Refill Agreement provide for an accounting of refill of New Bullards Bar Reservoir resulting from the proposed transfer during balanced conditions in the Delta. YCWA agrees that if there is an outstanding account of impacts after the 2005 reservoir refill period, YCWA would release additional water during subsequent balanced conditions in excess of normal operating requirements to compensate for identified impacts. However, if DWR made a flood release from Lake Oroville prior to full compensation of impacts on the SWP, or if Reclamation made a flood release from Shasta Reservoir prior to full compensation of impacts on the CVP, there would be no further obligation for releases by YCWA. DWR would work with Reclamation to allocate the impact account, if any, between the projects.

2.1.3.2 Lake Oroville

Water levels in Lake Oroville could be affected by the proposed transfer under either scenario only if DWR releases water to compensate for reduced flows to the Delta during the period when New Bullards Bar Reservoir is being refilled. As in past water transfers, YCWA would take measures to prevent adverse impacts on the SWP and CVP due to the refilling of New Bullards Bar Reservoir following the release of transfer water in 2005 (see “New Bullards Bar Reservoir Refill Conditions/Procedures” above).

2.1.3.3 Sacramento-San Joaquin Delta

The proposed transfer water would become part of the overall SWP or CVP water supply with related environmental and water quality protection limitations for exporting water from the Delta. The water transfer would move water through the Delta in summer and fall months and provide DWR with flexibility in regards to export pumping in a manner that would avoid significant impacts upon fisheries resources and SWP and CVP water supplies. As in recent water transfer years, it is anticipated that DWR would install temporary portable pumps in the south Delta at Old River and at Tom Paine Slough diversion structure to avoid impacts on water diverters due to potential water level drawdown effects associated with rediversion of the water transfer water from the Clifton Court Forebay and the Tracy Pumping Plant.

2.1.3.4 South of Delta Water Conveyance and Storage

DWR could elect to store some of the acquired water in groundwater banks south of the Delta, or as surface water storage in San Luis Reservoir. Water levels in groundwater banks or in San Luis Reservoir could increase during June through October by the volume of any transfer water stored in them, and then subsequently decrease by the same amount as the water is used.

South-of-Delta storage and conveyance facilities include:

> <u>California Aqueduct</u>. The California Aqueduct is California’s largest and longest water conveyance system, stretching from the Delta in the north to Lake Perris in the south (DWR 2001a). The aqueduct and its branches supply water for two-thirds of California’s population and irrigate approximately 1 million acres of farmland (DWR 2001a). The California Aqueduct conveys water to Southern California, as well as provides an irrigation supply to the Central (San Joaquin) Valley as part of the SWP. The aqueduct is approximately 444 miles long and most of the time is a wide, concrete lined ditch.
>
> <u>San Luis Reservoir</u>. San Luis Reservoir is an off-stream storage reservoir operated jointly by the CVP and SWP has a capacity of 2,041,000 acre-feet. San Luis Reservoir is located 12 miles west of the city of Los Banos on San Luis Creek, between the eastern foothills of the Diablo Range and the western foothills of the San Joaquin Valley in

Merced County (DWR 2001a). This major off-stream reservoir of the joint-use San Luis Complex stores excess winter and spring flows from the Delta and supplies water to service areas for both the SWP and CVP (DWR 2001a).

Groundwater Banks South of the Delta. DWR may elect to store some or all of the transferred water in groundwater banks south of the Delta. The extracted transfer water may be conveyed directly to water contractors via the California Aqueduct to supplement SWP supplies or it may be used by local districts for domestic and agricultural uses in exchange for an equivalent amount of their SWP entitlement water. Their entitlement would then be added to the amount of SWP water available for delivery to other SWP contractors.

If groundwater basins south of the Delta are used, the amount of water that would be extracted from them would be equivalent to the amount that is deposited. Water extracted from the groundwater banks for delivery in the California Aqueduct would be subject to certain conditions, particularly regarding water quality, and approval by DWR would be required before such delivery (EDAW 2004). In particular, DWR has developed acceptance criteria to govern the water quality of non-project water that may be conveyed through the California Aqueduct. Water that is transported through the California Aqueduct to downstream facilities has to meet the DWR water quality regulatory standards before it can enter into the California Aqueduct. DWR monitors SWP water quality to ensure that SWP water quality meets Department of Health Services drinking water standards and Article 19 Water Quality Objectives for long-term SWP contracts[2]. The CVP and SWP conveyance and storage facilities discussed above will be operated in accordance with applicable state and federal regulations, as well as the established plans, policies, and agreements identified in Section 7.0 of this Environmental Analysis.

It is presently uncertain how DWR would operate the water conveyance and storage facilities south of the Delta as a result of this proposed water transfer. The proposed water transfer is not expected to change the overall operations of the SWP and CVP facilities outside of normal operations.

2.1.4 YUBA GROUNDWATER SUB-BASIN PUMPING OPERATIONS

The maximum amount of water for the proposed 2005 transfer that would be derived from groundwater substitution would be up to 85,000 acre-feet. YCWA member units would pump additional groundwater for use within the YCWA service area to provide the groundwater substitution component of the water transfer, depending upon hydrologic and hydrogeologic conditions. Groundwater substitution involves YCWA member units agreement to temporarily pump groundwater rather than divert surface flows near Daguerre Point Dam. The surface water flows that otherwise would be diverted would thus be stored and released from New Bullards Bar Reservoir and allowed to flow down the lower Yuba River, Feather River, and Sacramento River and into the Delta. It is noted that the groundwater component of the transfer would be released from New Bullards Bar Reservoir with or without the transfer. The difference is that,

[2] Article 19 Objectives are included as standard provisions in DWR's water supply contracts. They require the collection and analysis of water quality samples in the SWP and the compilation of records. Article 19 (a) states: "*It shall be the objective of the State and the State shall take all reasonable measures to make available, at all delivery structures for delivery of Project water to the District, Project water of such quality that the following constituents do not exceed the concentrations stated*."

under the proposed transfer conditions, the member units would not divert the surface flows at Daguerre Point Dam.

The volume of the storage component of the total proposed transfer amount generally depends on YCWA's ability to reach a minimum carryover storage level in New Bullards Bar Reservoir with the transfer, ensuring that sufficient water would be available for YCWA service area deliveries in 2005 (EDAW 2004). The groundwater substitution component would be the amount of water needed to make up the balance of the total transfer (up to 85,000 acre-feet). The amount of the groundwater substitution component would be determined by May 1, 2005.

YCWA would operate in a manner that is consistent with YCWA's historical irrigation practices and agrees to comply with Water Code §1732 to protect groundwater resources. YCWA would manage the groundwater resources of the Yuba sub-basin to avoid impacts related to its use, including subsidence and water quality impacts. YCWA, in cooperation with DWR, would investigate any claim of adverse impact due to groundwater pumping conducted for the proposed 2005 transfer, and to adjust operations, as necessary, to address any such impact.

Groundwater Water Code §1745.10 and §1745.11 require the water supplier from whose service area the water is to be transferred (if a groundwater management plan has not been adopted pursuant to state law) to determine that groundwater use (*in lieu* of surface water) will not create or contribute to long-term overdraft in the affected groundwater basin. Analysis of the groundwater substitution portion of the proposed temporary change (MWH 2005) concludes that the proposed groundwater substitution component of the proposed water transfer would not result in any significant negative unmitigated Yuba groundwater sub-basin impacts or third-party impacts within Yuba County or surrounding areas.

YCWA, in cooperation with DWR, has monitored Yuba County groundwater conditions for over a decade, and many aspects of the groundwater resource are well known. For the proposed 2005 groundwater substitution transfer, the operations of the Yuba Project would be modified to provide assurance that the quantity of water pumped by member units *in lieu* of surface water deliveries is delivered to DWR.

In association with the proposed 2005 water transfer YCWA, in cooperation with DWR, has agreed to continue implementation of a Groundwater Program. The Groundwater Program would identify wells within the Yuba groundwater north and south sub-basins that could be affected by the proposed groundwater substitution practices. Implementation of monitoring elements of the plan would include recording measurements of the groundwater level both prior to and after pumping begins. Monitoring of groundwater levels in the groundwater sub-basins in excess of that which would have been pumped in the absence of the transfer would continue on a monthly basis until the groundwater level has returned to its pre-pumping depth. Additionally, to ensure salt intrusion into the groundwater wells is minimized, electrical conductivity (EC) measurements also would be taken before and after pumping begins, along with an intermediate measurement at two months into the transfer. DWR and YCWA will cooperate in obtaining these measurements. In addition to assessment of pumping effects upon the groundwater sub-basins, monitoring and reporting would be performed to evaluate and avoid potential effects upon surface waters. Specifically, selected monitoring locations will be determined to evaluate potential effects upon the Bear River (MWH 2005).

3.0 PROJECT SETTING

The man-made and natural water storage and conveyance systems that could be affected by the proposed transfer are located in California, from Yuba County and the Sierra foothills to Kern County and the southern San Joaquin Valley. This section describes the features and facilities in the area of study for the proposed temporary water transfer.

3.1 PROJECT LOCATION

YCWA will release water from New Bullards Bar Reservoir downstream into the lower Yuba River in Yuba County. DWR will receive, convey, and store YCWA transfer water in the Sacramento River and Delta as well as in San Luis Reservoir and groundwater banks south of the Delta.

3.1.1 YUBA RIVER

3.1.1.1 Surface Water Features and Management

The Yuba River Basin drains approximately 1,339 square miles of the western Sierra Nevada slope, including portions of Yuba, Sierra, Placer, and Nevada counties. The primary watercourses of the upper watershed are the South, Middle and North Yuba rivers, which flow into Englebright Reservoir, which then releases water into the lower Yuba River. Both the upper and lower watersheds (above and below Englebright Dam, respectively) have been extensively developed for water supply, hydropower production, and flood control. Operators of upper watershed projects include PG&E, Nevada Irrigation District and South Feather Water and Power District. The Yuba Project, which is operated by YCWA, includes water project operations in both the upper and lower watershed. The Yuba Project, completed in 1969, includes New Bullards Bar Dam and Reservoir, New Colgate Powerhouse, and Englebright Dam and Reservoir. The flow in the Yuba River is partially controlled by New Bullards Bar Reservoir, the largest reservoir in the watershed. It stores approximately 966,000 acre-feet of water, has a surface area of approximately 4,800 acres when full, and regulates winter and spring drainage from approximately 489 square miles of watershed on the Yuba River. YCWA stores water in New Bullards Bar Reservoir to provide for instream flows for fishery enhancement, flood control, power generation, recreation, and to provide irrigation water to member units that have both water rights and water service contracts. YCWA also has supplied water from New Bullards Bar Reservoir for municipal, industrial, and fish and wildlife purposes through a number of temporary water transfers each lasting less than one year.

Englebright Dam and Reservoir are downstream of New Bullards Bar Reservoir. Transfer water that is released from New Bullards Bar Reservoir generally passes through Englebright Reservoir without modifying Englebright Reservoir surface water elevations. Recent historical flows in the Yuba River below Englebright Dam during July and August have been between approximately 1,700 and 2,200 cfs during wet years and as low as 700 cfs during dry years or when snowpack water content is low. Daguerre Point Dam is approximately 12 miles downstream of Englebright Dam. During July and August, flows above Daguerre Point Dam are about 600 to 1,100 cfs higher than flows below the dam because of diversions at Daguerre Point Dam to meet irrigation demands. Specific without-transfer flows in 2005 are difficult to predict at this time because some of the rainy season remains, and therefore hydrologic conditions remain uncertain.

Within Yuba County, the Yuba River provides the majority of the regions surface water supply. YCWA is a major water right holder on the Yuba River. Various water districts, irrigation districts, water companies, and individuals contract with YCWA for delivery of water, including Brophy Water District, Browns Valley Irrigation District, Cordua Irrigation District, Dry Creek Mutual Water Company, Hallwood Irrigation District, Ramirez Water District, South Yuba Water District, and other smaller contractors. Some of the parties that receive water from YCWA have their own appropriative or riparian rights for diversion of water. Other agencies and districts providing surface water for irrigation in Yuba County include the Yuba County Water District, Browns Valley Irrigation District, Camp Far West Irrigation District, and Plumas Mutual Water Company.

3.1.1.2 Groundwater Features and Management

The basin from which the YCWA 2005 groundwater substitution component of the proposed transfer would be drawn is the Yuba County groundwater sub-basin, which lies within the Sacramento Valley groundwater basin. The sub-basin extends from the Sierra Nevada foothills on the east to the Feather River on the west. The southern boundary is the Bear River and the northern boundary is Honcut Creek. The sub-basin encompasses an area of approximately 270 square miles. The sub-basin area is bounded on the east by the impermeable rocks of the Sierra Nevada. These same rocks and younger consolidated rocks extend beneath the sub-basin at a gradually increasing depth toward the Feather River and beyond to the trough of the Sacramento Valley. Fresh groundwater is stored in this wedge-shaped body of alluvial material to depths of 1,000 feet. Groundwater occurs generally under water table or unconfined conditions throughout most of the groundwater sub-basin. Confinement probably occurs at depths in excess of 300 to 400 feet.

The Yuba River hydraulically divides the Yuba groundwater sub-basin into the Yuba North sub-basin and the Yuba South sub-basin. The total groundwater storage capacity of the Yuba County groundwater sub-basin is 1,710,000 acre-feet, 40 percent of which is in the Yuba North sub-basin and 60 percent of which is in the Yuba South sub-basin. The portion of the sub-basin from 20 to 100 feet in depth is estimated to have a total storage capacity of 540,000 acre-feet, and the portion between 20 and 50-feet-in-depth is estimated to have a total storage capacity of 340,000 acre-feet. Although these numbers do not represent the operational characteristics (e.g., recharge rate, recharge origin, pumping effects) they do demonstrate that a substantial water source is available within the sub-basin.

Groundwater accounts for about 31 percent, or 130,000 acre-feet of irrigation water use in Yuba County. At least 385 wells, which provide water for irrigation, are located in the YCWA service area. In recent years, YCWA has provided surface water to areas previously served by groundwater, thereby decreasing demands on the groundwater basin. Over the past decade, YCWA and its member units have taken an active and progressive role in managing the groundwater resources of the Yuba groundwater sub-basin. YCWA also works with DWR in monitoring the groundwater basin. Several of the districts in Yuba County have adopted groundwater management plans and YCWA has a plan under consideration. As part of basin management, YCWA, DWR, and the member districts have instituted a Groundwater Monitoring and Reporting Program to record in detail the water levels and water quality of the groundwater sub-basins. Additional information regarding the Groundwater Monitoring Program is included in Section 4.3.3, Groundwater Resources.

Detailed information on the groundwater sub-basins, including physical characteristics and long-term trends in water levels, is provided the Groundwater Analysis submitted to the SWRCB in support of the 2005 water transfer petition under separate cover.

3.1.2 FEATHER RIVER

The Feather River flows south for 67 miles from Oroville Dam and empties into the Sacramento River near Verona. Flows in the Feather River are controlled primarily by DWR's Oroville Dam, which stores 3.5 million acre-feet of water in Lake Oroville. A minimum flow of 600 cfs is maintained in the 8-mile low-flow section of the Feather River between the Fish Barrier Dam and the river outlet from the Thermalito Afterbay. A minimum flow of approximately 1,700 cfs is maintained in the 59-mile high flow section of the Feather River below the Thermalito Afterbay river outlet. Average flows in the Feather River during July and August are 7,600 cfs during wet years, 5,750 cfs during above-normal years, 4,700 cfs during below normal years 4,050 cfs during dry years, and 2,950 cfs during critically dry years (YCWA 1998 *as cited in* EDAW 2004).

3.1.3 SACRAMENTO RIVER

The Sacramento River, which originates in the Cascade and Siskiyou Mountains of northern California and terminates in the Delta, is the largest river in California. Flows in the Sacramento River are controlled primarily by Reclamation's Shasta Dam. Flow on the Sacramento River at Keswick in July and August averages approximately 12,500 cfs during wet years, 9,200 cfs during above-normal years, 7,600 cfs during below-normal years, 7,300 cfs during dry years, and 6,100 cfs during critically dry years (YCWA 1998 *as cited in* EDAW 2004).

3.1.4 SACRAMENTO-SAN JOAQUIN DELTA

The Delta, located at the confluence of the Sacramento and San Joaquin rivers, serves as the major hub for the operations of both the SWP and CVP. DWR operates its Harvey O. Banks Pumping Plant in the southern Delta to lift water into the California Aqueduct for delivery to SWP customers in the San Joaquin Valley and to southern California. Reclamation operates its Tracy Pumping Plant to lift water from the southern Delta into the Delta-Mendota Canal to service CVP contractors in the San Joaquin Valley and the Tulare Basin. Current SWP and CVP operations in the Delta are governed by a series of regulations and agreements with SWRCB, USFWS, NMFS, and CDFG. These regulations and agreements limit the volume of water that can be exported from the Delta based on Delta hydrodynamics, water quality, and potential impacts on fisheries as determined by fish population monitoring at the pumps. Projected flow conditions and export demand in 2005 likely will create a window possibly as early as June, but definitely in July through October, to allow for the export of YCWA transfer water.

Water conditions in the south Delta area are influenced in varying degrees by natural tidal fluctuation, San Joaquin river flow and quality, local agricultural drainage water, SWP and CVP export pumping, local diversions, operation of the Delta Cross Channel and tidal barrier facilities, channel capacity, and regulatory constraints. These factors affect water levels and availability at some local diversion points. When the SWP and CVP are exporting water, water levels in local channels can be drawn down. Also, flows can diverge and converge in some channels. If local agricultural drainage water is pumped into the channels where circulation is poor, water quality can be affected. The South Delta Temporary Barriers Project, initiated in 1991, has been used to provide short-term improvement of water conditions for the south Delta. The South Delta Temporary Barriers Project involves the seasonal installation of four barriers: one in Middle River, two in Old River, and one in Grant Line Canal. Three of the barriers are designed to improve water levels and circulation for agricultural diversions. These barriers are installed by DWR and Reclamation on a seasonal basis as needed to improve water levels and water quality.

South-of-Delta storage and conveyance facilities, including the California Aqueduct, San Luis Reservoir, and groundwater banks are described in Section 2.1.3.4, South of Delta Water Conveyance and Storage.

4.0 ENVIRONMENTAL SETTING AND IMPACTS

4.1 INTRODUCTION

This section describes the environmental setting for the proposed temporary water transfer and evaluates the potential for effects on fisheries, wildlife and other instream beneficial uses. The proposed transfer does not include any new construction of water facilities, infrastructure, or any other type of construction or land disturbance. The transfer, therefore, will not have any construction-related effects. In accordance with Water Code §1727, this evaluation draws conclusions regarding whether the proposed transfer "*would unreasonably affect fish, wildlife, or other instream beneficial uses*." Instream beneficial uses analyzed in this document include surface water supply availability and water quality, groundwater resources, fisheries and aquatic resources, terrestrial resources (wildlife and vegetation), recreation, and carryover storage. Additionally, other environmental topics discussed in this section include air quality and cultural resources because of the mitigation commitments required of water districts selling water under the EWA (EWA Final EIS/EIR and Record of Decision for the Short-Term Environmental Water Account Final EIS/EIR).

4.2 YUBA COUNTY WATER AGENCY'S WATER RIGHTS

YCWA's water right permits authorize diversion of water to storage at New Bullards Bar Reservoir and allow direct diversion of water downstream for consumptive uses. YCWA's permits authorize direct diversion at a total rate of 1,550 cubic feet per second (cfs) from the lower Yuba River for irrigation and other uses from September 1 to June 30, and the diversion of 961,300 acre-feet to storage in New Bullards Bar Reservoir from October 1 to June 30 (SWRCB 2003). The points of diversion to storage and rediversion for Permit 15026 are located at the New Bullards Bar Dam and the Daguerre Point Dam. The water is used for irrigation, industrial, recreational, fish mitigation and enhancement, and domestic purposes within the authorized place of use as shown on map EI-05-08-RS on file with the SWRCB under Application 5632. In addition to providing water for consumptive use, water is released for power generation at the Colgate Powerhouse below New Bullards Bar Dam and at the Narrows I and Narrows II powerhouses below Englebright Dam. Hydroelectric power is generated at those locations under authorization from FERC and eight water right licenses issued by the SWRCB.

Based on evidentiary hearings held in 1992 and 2000 regarding fishery resources and water right issues of the lower Yuba River, the SWRCB adopted RD-1644, which includes instream flow requirements. As conditioned by RD-1644, Permit 15026 contains instream flow requirements measured at the Marysville Gage (located about 6 miles upstream of the confluence of the Feather and Yuba rivers) and the Smartville Gage (located just below Englebright Reservoir).

4.3 WATER RESOURCES

4.3.1 WATER SUPPLY AVAILABILITY

4.3.1.1 Environmental Setting

The surface water bodies potentially affected by the proposed water transfer include New Bullards Bar Reservoir, the lower Yuba River, Lake Oroville and the lower Feather River, the Sacramento River, the Delta, and San Luis Reservoir. For a further description of each of these water bodies and facilities, please refer to Section 3.0, Project Setting and Section 2.1.3.4, South of Delta Water Conveyance and Storage.

4.3.1.2 Impact Assessment Methodology

The analysis of the potential effects on surface water supply availability associated with the proposed water transfer within the affected water bodies, listed above, was based on the following criteria:

- Reductions in reservoir storage or river flows, relative to the without-transfer condition, of significant frequency and duration, to adversely affect the water supply availability to customers and/or contractors.

The evaluation of potential effects of the proposed water transfer on surface water availability was based upon anticipated river flow or reservoir storage changes that could occur under proposed transfer conditions relative to without-transfer conditions. The anticipated change in reservoir water surface elevation was evaluated to determine the likelihood that decreases in reservoir water surface elevations of sufficient magnitude and duration would occur and result in adverse effects to water supply availability. The potential change in river flow was assessed to determine the likelihood that decreases in river flows of sufficient magnitude and duration would occur and result in adverse effects to water supply availability. Increases in reservoir water surface elevation or river flows were considered to have no unreasonable effect upon water supply availability.

4.3.1.3 Impact Assessment

Yuba River

The proposed water transfer would result in a change in the hydrologic pattern for the Yuba River below New Bullards Bar Reservoir, although flows within the lower Yuba River would remain within normal operational conditions. The annual supply of water would not decrease and there would not be an adverse or unreasonable effect upon water supply availability. Additionally, YCWA would continue historic irrigation practices to avoid significant changes in surface water levels for agricultural supplies. The proposed water transfer, under either the maximum or minimum water transfer scenario, would result in increased flows in the lower Yuba River for the duration of the transfer (June or July through September and including the first two weeks of October 2005 for the BVID transfer to SCVWD). Therefore, no unreasonable effects to surface water supply availability would be expected for water agencies and their customers or contractors that utilize the Yuba River, under the proposed water transfer.

New Bullards Bar Reservoir

Implementation of the proposed water transfer would alter the hydrologic pattern relative to the without-transfer condition; however, reservoir storage and water surface elevations at New Bullards Bar Reservoir would be within normal operational parameters. Under the maximum transfer scenario, water storage at New Bullards Bar Reservoir would decrease by up to 100,000 acre-feet by the end of the transfer period, relative to the without-transfer condition. The resultant 605,000 acre-feet storage level anticipated for New Bullards Bar Reservoir with the proposed water transfer would be within the range of historical operation and would not result in drawdown of the reservoir below minimum storage levels. Under the minimum transfer scenario, water storage at New Bullards Bar Reservoir would decrease by up to 62,000 acre-feet by the end of the transfer period (mid-October 2005), relative to the without-transfer condition. The resultant 643,000 acre-feet storage level under this scenario also would be within the range of historical operations at New Bullards Bar Reservoir and would not result in drawdown of the reservoir below minimum storage levels. Under either water transfer scenario, the decrease in reservoir storage would not be of substantial magnitude or duration, relative to the without-transfer condition, to adversely affect water supply availability from New Bullards Bar Reservoir. YCWA would ensure that sufficient carryover water is available in New Bullards Bar Reservoir in 2006 to meet all contractual, regulatory, and environmental needs (refer to Appendix A for additional discussion). Therefore, no adverse or unreasonable effects to surface water supply availability are anticipated at New Bullards Bar Reservoir under the proposed water transfer.

Feather River and Lake Oroville

The effect of the proposed water transfer would not be expected to result in Feather River flows or Lake Oroville storage levels outside of normal operational parameters. Under the maximum transfer scenario, Feather River flows below the Yuba River potentially would increase by 100 cfs (October, Below Normal water year) to 1,023 cfs (July and August, Dry water year) with the proposed water transfer relative to the without-transfer conditions for the months of June through October. Under the minimum water transfer scenario, Feather River flows below the Yuba River potentially would increase by 100 cfs (October, Below Normal water year) to 450 cfs (July and August, Dry water Year) with the proposed water transfer, relative to the without-transfer conditions for the months of June through October. As described in the Hydrologic Analysis (Appendix A) Feather River flows for 2005 are anticipated to range from four to five times higher than the Yuba River flows, therefore, the influence of Yuba River flows on total Feather River flows is not likely to be substantial. Overall, potential changes to Feather River flows under either proposed water transfer scenario would not be expected to result in unreasonable impacts upon surface water availability for water supply purposes.

Although the specific operational scenario for Lake Oroville is unknown, reservoir storage changes that occur as a result of the proposed water transfer (due to potential effects associated with subsequent refill of New Bullards Bar Reservoir) would be expected to remain within historic operational ranges and therefore would not adversely or unreasonably affect water supply availability to water customers, including CVP and SWP contractors, relative to the without-transfer condition.

Sacramento River

Implementation of either proposed water transfer scenario potentially would slightly alter flows within the Sacramento River, potentially within the same ranges as described above for the Feather River. However, Sacramento River flows are anticipated to remain within normal flow ranges and fluctuations resulting from SWP and CVP operations. Although the specific operational scenario associated with the proposed water transfer is uncertain, the potential flow changes due to either scenario for the proposed water transfer would be a relatively small proportion of total Sacramento River flows during the transfer period, and are not expected to adversely or unreasonably affect water supply availability to water customers, including CVP and SWP contractors, relative to the without-transfer condition.

Sacramento-San Joaquin Delta

Although the hydrologic pattern may be slightly altered with the implementation of the proposed water transfer, Delta conditions are anticipated to remain within the normal flow ranges and fluctuations resulting from SWP and CVP operations, under either the maximum or minimum transfer scenario. Although the specific operational scenario associated with the proposed water transfer is uncertain, the projected flow changes are not expected to adversely or unreasonably affect water supply availability to CVP and SWP customers, relative to the without-transfer condition. Coordination with numerous agencies (YCWA, DWR, Reclamation, USFWS, NMFS, CDFG) has been initiated and would continue to take place to ensure that water supply effects would not occur and that water would be transferred within the most environmentally protective "windows" that exist when conveyance capacity is available, and pumping restrictions would not preclude the transfer of water.

San Luis Reservoir

DWR likely will store some portion of the acquired transfer water in San Luis Reservoir. Because the water is intended for use in the EWA and DWR Dry Year Water programs, it is intended to potentially provide a beneficial effect upon SWP and/or CVP contractor water supply conditions in 2005. There would be no unreasonable impact upon water supply at San Luis Reservoir.

4.3.2 SURFACE WATER QUALITY

4.3.2.1 Environmental Setting

The following section provides a discussion of the water quality setting for the Yuba River, New Bullards Bar Reservoir, Feather River, Lake Oroville, Sacramento River, Delta and San Luis Reservoir.

Yuba River and New Bullards Bar Reservoir

The Yuba River is the largest tributary to the Feather River. Forestland is the primary land use and land cover for the Yuba River basin, comprising about 85 percent of the land cover (USGS 2002 *as cited in* DWR and Reclamation 2003). The forestland in the Yuba River Basin is located in the foothills of the Sierra Nevada, which also experienced a substantial amount of gold mining, including placer and hard rock mines. Mercury was used in the basin to recover gold from both placer deposits and ore-bearing minerals. Residual mercury from those operations has been detected in invertebrate and fish communities nearby and downstream from the gold mining operations (Slotton *et al.* 1997 *as cited in* DWR and Reclamation 2003; May *et al*. 2000 *as cited in* DWR and Reclamation 2003).

The general water quality of the lower Yuba River is considered good and has improved in recent decades due to control of hydraulic and dredge mining operations, and the establishment of minimum instream flows (Beak 1989). Dissolved oxygen concentrations, total dissolved solids, pH, hardness, alkalinity, and turbidity are well within acceptable or preferred ranges for salmonids and other key freshwater biota (DWR and Reclamation 2003).

YCWA currently supplies raw water exclusively for agricultural purposes in YCWA's service area. YCWA is selling and delivering water to DWR, which has contracting agencies that have water treatment plants that would make YCWA water available for municipal supply.

Feather River

The Feather River is a large tributary to the Sacramento River. Flow in the lower Feather River is controlled mainly by releases from Lake Oroville, the second largest reservoir within the Sacramento River Basin, and by flow from the Yuba River, a major tributary. Forestland is the major (about 78 percent of total) land use or land cover for the Feather River basin. Gold mining also was an important land use in the Sierra Nevada foothills that are part of the Feather River basin. The Yuba and the Bear rivers both flow into the lower Feather River. Both the Yuba River and the Bear River basins have been affected by past gold mining and contribute mercury to the lower Feather and Sacramento rivers (May et. al. 2000 *as cited in* DWR and Reclamation 2003). Constituents of concern for the Feather River, according to the Clean Water Act Section 303(d) list, include diazinon, group A pesticides, mercury and unknown toxicity. Potential sources of these constituents include agriculture, urban runoff, storm sewers, resource extraction and other unknown sources (DWR and Reclamation 2003).

Lake Oroville

Lake Oroville is primarily used for water supply, power generation, flood control, fish and wildlife enhancement, and recreational purposes (DWR 2001b *as cited in* DWR and Reclamation 2003). Water quality in Lake Oroville is influenced by tributary streams, of which the Middle, North, and South forks of the Feather River contribute the bulk of the inflow to the reservoir. Water quality in Lake Oroville generally is more influenced by recreation activities and other historical land-based activities (i.e., mining) than by project operations. Overall, based on preliminary on-going investigations being conducted under the Oroville Facilities FERC Relicensing studies (www.orovillerelicensing.water.ca.gov, web page accessed February 21, 2005), Lake Oroville water quality typically meets Central Valley Regional Water Quality Control Plan (Basin Plan) objectives for intended beneficial uses. Preliminary information indicates infrequent and minor exceedances for some constituents (DO, pH and nutrients) and more frequent exceedances of some metals (arsenic, aluminum and iron). Elevated metals concentrations potentially are related to wind disturbances and movement of bottom sediments as well as from storm runoff events.

Sacramento River

The lower Sacramento River receives urban runoff, either directly or indirectly (through tributary inflow), from the cities of Sacramento, Roseville, Folsom, and their surrounding communities. The Natomas East Main Drainage Canal discharges to the Sacramento River immediately upstream of the confluence with the American River. This canal transfers both agricultural discharges and urban runoff into the Sacramento River.

Sacramento River water quality monitoring studies indicate that the river's water is generally of high quality (Larry Walker Associates 1991, 1996; Brown and Caldwell *et al*. 1995). Concentrations of some trace elements (particularly copper and zinc) frequently approach limits established by regulatory agencies while other metals such as lead, cadmium, mercury, and silver may also approach these limits. Much of the trace element loadings in the Sacramento River are from non-permitted sources. Acid mine drainage contributes cadmium, copper, and zinc, while agricultural return flows typically contribute chromium and nickel. Discharges of urban runoff and seasonal agricultural runoff are the principal sources of water quality problems in the Sacramento River near its confluence with the American River (Corps 1991). Water quality of the Sacramento River near its confluence with the American River ranges from medium to good for numerous beneficial uses (SWRCB 1994).

Sacramento-San Joaquin Delta

Water quality in the Delta is influenced by a combination of environmental and institutional variables, including upstream pollutant loading, water export and diversions within and upstream of the Delta, and agricultural activities in the Delta. The tidal currents carry large volumes of seawater back and forth through the Bay Delta Estuary with each tide cycle. The mixing zone of saltwater and freshwater can shift two to six miles depending on the tides, and may reach far into the Delta during periods of low inflow. Thus, the inflow of the tributaries into the Delta is essential in maintaining the water quality in the Delta.

Metals, pesticides and petroleum hydrocarbons enter the Delta through several means, including agricultural runoff, municipal and industrial wastewater discharge, urban runoff, recreational uses, river inflow, and atmospheric deposition (San Francisco Estuary Project 1992). The concentrations of these pollutants in the Delta vary geographically and seasonally. The toxic effects of pollutants on aquatic life can vary with flow levels; however, water flowing into and through the Delta acts to dilute concentrations of toxicants.

San Luis Reservoir

In general, the natural inflow from the San Luis Reservoir watershed is insignificant relative to the reservoir's capacity (DWR 2001a). Most of the reservoir's water is pumped from the California Aqueduct and the Delta-Mendota Canal via the O'Neill Forebay through the Gianelli Pumping-Generating Plant during the winter and spring (DWR 2001a). Water enters and exits San Luis Reservoir from a common inlet/outlet tower (DWR 2001a). In addition, Reclamation pumps water out of San Luis Reservoir in a westerly direction to San Felipe Division Water contractors through the Pacheco Pumping Plant and the Santa Clara Tunnel (DWR 2001a). San Luis Reservoir water is delivered to the San Joaquin Valley, the Santa Clara Valley, and Southern California when water supply in the California Aqueduct and the Delta Mendota Canal is insufficient (DWR 2001a).

In San Luis Reservoir, the low-point problem and associated algal growth is the primary water quality concern. In San Luis Reservoir, the low point refers to a range of minimum reservoir levels that occur in late summer and fall. The low-point problem is produced by a combination of warm-season algae growth and decreasing summer water levels (DWR and Reclamation 2003). High algae content reduces the effectiveness of water treatment and can affect the quality and taste of treated water. As the reservoir is progressively drawn down below 300,000 acre-feet, increasing amounts of algae may enter the intake, and water quality problems can arise. Typically, taste and odor concerns associated with algal growth in the reservoir are more serious water quality concerns during drought years (DWR 2001a). In the fall, especially during drought years, a greater demand by SWP contractors creates lower water levels in the reservoir (DWR 2001a). Because of the improved light penetration and greater likelihood of establishment of a thermocline in the reservoir, algal blooms, consisting primarily of the blue-green algae *Aphanizomenon flosaquae*, are more likely to occur (DWR 2001a). During fall months, winds blow accumulated blue-green algae toward the intake, and taste and odor concerns may result (DWR 2001a). The EWA EIS/EIR (DWR and Reclamation 2003) presents a detailed description of the San Luis Reservoir low-point topic.

4.3.2.2 Impact Assessment Methodology

The analysis of potential effects on surface water quality associated with the proposed water transfer within potentially affected water bodies was based on the following criteria:

- Decrease in reservoir storage, of sufficient magnitude or duration relative to the without-transfer condition, to result in an increase in the concentration of contaminants.
- Decrease in river flow, of sufficient magnitude or duration relative to the without-transfer condition, to result in an increase in the concentration of contaminants.

The evaluation of potential effects of the proposed water transfer on surface water quality was based upon anticipated river flow or reservoir storage changes that could occur under proposed transfer conditions relative to without-transfer conditions. The anticipated change in reservoir storage was evaluated to determine the likelihood that decreases in reservoir water surface elevations of sufficient magnitude and duration would occur and result in adverse effects to water quality. The potential change in river flows was assessed to determine the likelihood that decreases in river flows of sufficient magnitude and duration would occur and result in adverse effects to water quality. Increases in reservoir storage or river flows were considered to have a slightly beneficial or no effect upon surface water quality due to the potential for increased dilution of contaminants.

Consultation with the Central Valley Regional Water Quality Control Board (RWQCB) for the proposed water transfer led to the identification of potential concerns related to the possibility of a shift in hardness levels due to transfer of water of different hardness level related to the water bodies receiving the transfer water inflow. Therefore, a discussion of this topic is provided following the water-body specific analyses presented in this section. Determination of the potential for an unreasonable effect is based on the following criteria:

- Increased potential for a substantial shift in hardness levels of the water bodies receiving the transfer source water, relative to the without-transfer condition, of sufficient magnitude that the potential for increased bioavailability of metals would occur (e.g., substantially lower hardness level in the source water than in the receiving water)

4.3.2.3 Impact Assessment

Yuba River

The proposed water transfer would result in increased instream flows in the Yuba River, relative to the without-transfer condition. Under the proposed water transfer, there would be no decrease in flows along the lower Yuba River, relative to the without-transfer condition. Because no decreases in flows would occur under the proposed water transfer, there would be no adverse or unreasonable water quality impacts in the lower Yuba River. Moreover, the increases in flows may provide a beneficial effect to the water quality in the lower Yuba River by increasing the dilution of contaminants.

Feather River

The proposed water transfer potentially would result in slight flow increases in the Feather River during the months of the proposed water transfers (June/July through mid-October); however, Feather Rivers flows are anticipated to remain within normal historical flow levels for this time period. A slight increase in flows during summer months potentially could provide a beneficial effect to water quality in the Feather River by increasing the dilution of contaminant constituents. The proposed water transfer would not affect contribution of constituents of concern for the Feather River. Overall, the proposed water transfer would not be expected to result in unreasonable water quality impacts to the Feather River, relative to the without-transfer conditions.

Lake Oroville

Lake Oroville water levels would not be anticipated to be substantially affected by the proposed water transfer, and, thus the water transfer condition, relative to the without-transfer condition, would not result in unreasonable water quality impacts upon Lake Oroville. In the event that DWR releases water to compensate for reduced Delta flows during refill of New Bullards Bar

Reservoir, the Refill Agreement between YCWA and DWR would ensure mitigation of any potential impacts upon the SWP and/or CVP facilities.

Sacramento River

Flows within the Sacramento River may be slightly higher during the proposed water transfer period but are expected to remain within the range of normal flow ranges and fluctuations resulting from SWP and CVP operations. Although the specific operational scenario associated with the proposed water transfer is uncertain, the magnitude and duration of the projected flow changes are not expected to adversely or unreasonably affect water quality within the lower Sacramento River, relative to the without-transfer condition.

Sacramento-San Joaquin Delta

DWR is responsible for mitigating its water quality impacts as required under the 1995 Delta Water Quality Control Plan (SWRCB 1995). Some operation changes may have to be made to meet these standards, but DWR's ability to meet these standards will not be compromised under proposed water transfer conditions relative to without-transfer conditions. No adverse or unreasonable water quality effects are expected to occur as a result of this proposed water transfer.

DWR monitors SWP water quality to ensure that SWP water supplies meet the Department of Health Services drinking water standards and Article 19 Water Quality Objectives[3] for long-term SWP contracts. The objective of the SWP water quality monitoring program is to maintain project water at a quality acceptable for recreation, agriculture, and public water supply for the present and future under a policy of multiple use of SWP facilities. These uses include fishing, boating, and water contact sports. DWR analyzes the water for physical parameters such as water temperature, specific conductance, and turbidity and more than 60 different chemical constituents, including inorganic chemicals, pesticides, and organic carbon potential. The monitoring program has stations throughout the SWP, including the O'Neill Forebay in San Luis Reservoir; the California Aqueduct, and terminal reservoirs such as Silverwood Lake, Lake Perris, Pyramid Lake, and Castaic Lake.

San Luis Reservoir

To the extent that the proposed transferred water is stored in San Luis Reservoir during summer and fall months when potential concerns related to the Low Point occur, the transfer of this water potentially could provide a beneficial effect, under either the minimum or maximum water transfer scenario. Although the SWP operations related to the transfer are unknown, it is expected that DWR would operate according to prevailing regulatory water quality and environmental protection requirements and that San Luis Reservoir water elevations would

[3] Article 19 objectives are included as standard provisions in DWR's water supply contracts. They require the collection and analysis of water quality samples in the SWP and the compilation of records. Article 19 (a) states: "*It shall be the objective of the state and the state shall take all reasonable measure to make available, at all delivery structure s for the delivery of project water to the district, project water of such quality that the following constituents do not exceed the concentrations stated.*"

remain within normal operating ranges. Therefore, the proposed water transfer would not be expected to result in unreasonable effects upon San Luis Reservoir water quality.

Discussion of Potential Water Quality Concerns Related to Hardness Levels

The RWQCB requested that this Environmental Analysis provide information regarding hardness levels of the water bodies potentially affected by the proposed 2005 water transfer. RWQCB recently determined that water transfers have the potential to result in effects upon water quality when the water bodies are of substantially different hardness levels. In particular, if the transfer source water has a lower water hardness level than the receiving water, there is the potential for the transfer to cause a shift (reduction) in hardness levels in the receiving water thereby causing metals in the water to become more bioavailable than they were previously (Pers. Comm. Richard McHenry, RWQCB 2005). The potential for water quality effects depends upon the dilution potential and on the concentrations of metals in the affected waterbodies. The following provides a discussion of hardness levels in the affected water systems, as provided by the Regional Board (Pers. Comm. Richard McHenry and Karen Niiya, RWQCB 2005) and an assessment of the potential effects of the proposed water transfer.

RWQCB indicated that the hardness levels for the Yuba and Feather rivers is generally in the range of 40 mg/L, $CaCO_3$. Data for the Feather River for the period of March through November 2002 indicated a low value of 37 mg/L $CaCO_3$ and a high of 40 mg/L $CaCO_3$ (Pers. Comm. Richard McHenry). Sacramento River (near Freeport) hardness levels were reported to range from a low of 26 mg/L $CaCO_3$ to a high of 160 mg/L $CaCO_3$ for the period of January 1998 through November 2002 (Pers. Comm. Karen Niiya). Hardness levels for the Delta are reported to be in the range of 90 to 100 mg/L $CaCO_3$ (http://www.ccwater.com/waterquality/faq.asp#hard, web page accessed March 3, 2005). According to the RWQCB, these ranges of hardness levels between the affected water systems do not represent a significant water quality issue for this water transfer.

Additionally, because the Feather River and Sacramento River flows are substantially higher than the Yuba River flows and the anticipated peak transfer volume, there is adequate dilution potential to reduce the possibility of a shift in hardness levels that would result in a water quality concern in any of the receiving water bodies. The maximum water transfer scenario potentially would result in flows of approximately 970 to 1,023 cfs above minimum instream flow requirements for the lower Yuba River (Below Normal or Dry water year, respectively), potentially resulting in Yuba River flows into the Feather River of under 1,500 cfs in either water year type (Appendix A, Marysville Gage). Flows in the Feather River are anticipated to be approximately four to five times higher than the Yuba River flows for the summer of 2005 (Appendix A) and, as described previously, Sacramento River flows during the proposed transfer period range from over 12,000 cfs to more than 16,000 cfs, again providing adequate dilution potential. The proposed water transfer therefore would not be likely to result in a substantial shift in hardness levels as the water flowed from the Yuba River to the Feather River, Sacramento River and into the Delta. The proposed water transfer would not result in an unreasonable effect upon water quality due to variations in hardness levels among water systems.

4.3.3 GROUNDWATER RESOURCES

Groundwater resources are described and evaluated in detail in the Groundwater Analysis (MWH 2005) and in the EWA EIS/EIR (DWR and Reclamation 2003). Information presented below is based upon these documents.

4.3.3.1 Environmental Setting

Groundwater

Yuba Groundwater Sub-basin

The 2005 YCWA groundwater substitution component of the proposed water transfer would utilize the Yuba County groundwater sub-basin. The sub-basin is described in Section 3.1.1.2, Groundwater Features and Management.

South-of-the-Delta Groundwater Banks

DWR potentially would store a portion of the transferred water in groundwater banks south of the Delta within the San Joaquin Groundwater Basin. The specific groundwater banking operations associated with the proposed water transfer are unknown. The EWA EIS/EIR provides detailed information regarding South-of-Delta Groundwater Banks, including participating agencies in Kern County that could be utilized as part of the EWA. Groundwater in the South San Joaquin Groundwater Basin has historically been used heavily, and excessive groundwater withdrawals have caused substantial declines in groundwater levels. However, as reported in the EWA EIS/EIR (DWR and Reclamation 2003), groundwater levels have substantially increased relative to pre-project groundwater levels in several groundwater banks.

4.3.3.2 Impact Assessment Methodology

The evaluation of potential groundwater resources impacts due to the proposed water transfer is based upon the assessments provided in the Groundwater Analysis (MWH 2005) and the analyses in the EWA EIS/EIR (DWR and Reclamation 2003). Potential effects upon groundwater resources were determined based on the following criteria:

- Decline in groundwater levels of sufficient duration and magnitude, relative to the without-transfer condition, that would result in long-term effects on the groundwater basin;

- Groundwater pumping that results in reduction of surface water flows due to the relationship between groundwater and surface water interactions, relative to the without-transfer condition of sufficient magnitude and duration such that riparian habitat would be adversely affected;

- Groundwater pumping that results in increased migration of reduced quality water, relative to the without-transfer condition, such that potential long-term effects occur upon the quality of groundwater resources in the groundwater basin.

4.3.3.3 Impact Assessment

Yuba Groundwater Sub-basin

The proposed 2005 water transfer potentially would involve groundwater substitution of up to approximately 85,000 acre-feet. Approximately half of the groundwater pumping would occur from the North Yuba sub-basin and the other half of groundwater pumping would occur from the South Yuba sub-basin. The increased pumping potentially could affect groundwater hydrology, including decline in groundwater levels, surface water interactions, and groundwater quality.

Groundwater Levels

Groundwater substitution may result in temporary declines in groundwater levels. Historical groundwater levels are different for the North Yuba sub-basin and the South Yuba sub-basin. Groundwater levels in the North Yuba sub-basin generally declined prior to the mid-1960s, were relatively stable until about 1980, and have subsequently recovered to near historic high levels. Imposed on these general trends are single year declines that have occurred in dry years with rapid recovery during the following winter season. The South Yuba sub-basin experienced long-term declines in water levels, indicative of overdraft, through the early 1980s. Subsequent to the development of the Yuba River Operating Program, deliveries of surface water began with the completion of the initial phase of the South Yuba Canal in 1983. Extension of the canal continues to this day with increasing areas of the South Yuba sub-basin receiving surface water with a concomitant reduction in groundwater use. Groundwater levels in the South Yuba sub-basin have risen as much as 100 feet in some areas. These water level rises coupled with the experience gained from recent water transfers indicate that the potential effects of the proposed water transfer would not be expected to alter long-term water level trends (MWH 2005; DWR and Reclamation 2003).

Increased groundwater pumping could cause localized declines of groundwater levels, or the development of cones of depression near pumping wells. In order to address these potential local declines, DWR and YCWA will implement a cooperative monitoring program during the groundwater substitution transfer to ensure that immediate remedial action would be taken to mitigate any identified impacts.

In preparation for the 2004 transfer, YCWA and member districts refined the program from earlier years for responding to groundwater users who raise issues of impact due to the potential affects of the transfer. That refined program will be implemented for the 2005 transfer. As part of the transfer monitoring and mitigation plan, YCWA and member districts have implemented a rapid response program to immediately investigate any claim of a potential impact. The process involves: (1) immediate response; (2) collection of relevant information; (3) analysis of the information and a determination of the likely cause; and, (4) if appropriate, implementation of mitigation measures. A key part of this program is the designation of a point of contact at YCWA and at each member district that will respond so that no time is lost in addressing the issue.

DWR and YCWA will be contractually agreeing to monitor the basins extensively and investigate any instances of potential impact and to address these issues. One area that was closely monitored for the 2002 operations was the Las Quintas area in the Yuba North Basin. This area, located at the base of the foothills on the eastern side of the basin, consists of a hill that has been recently developed as a residential subdivision. Because of this recent development, many of the homes in this area, which rely on individual domestic wells, have not experienced the groundwater levels that were reached in 1991 or 1994 or the extended lower levels of the 1950s to the 1970s. Several of the wells in this area were constructed to extend only a short distance into the water table. In recent years, groundwater levels have been higher than historical levels, and these wells, which were recently constructed, were not designed to pump water when the water table is at the lower historical levels. The 2001 transfer operations affected wells in the Las Quintas area (lower groundwater levels). Because of the lower levels, either reduced well pumping capacity or loss of pumping capacity occurred, and in response, the Cordua Irrigation District (the member district for this area) lowered the pumps and/or deepened the wells for five residences. Ultimately, no significant long-term or unmitigated impacts to the residents of this area occurred.

For the 2002 operations, residents expressed concern about the effects of groundwater substitution transfers. Therefore, YCWA and the Cordua Irrigation District have met with, and are continuing to work with, these residents to address their concerns.

Interaction with Surface Water

River flows could be reduced through pumping close to the Bear River to the south, or the Yuba River that flows through the sub-basins. The Feather River borders the area on the west but pumping in support of water transfers does not occur near the river. Pumping has the potential to adversely affect the riparian and aquatic habitats and downstream water users. However, effects to riparian and aquatic habitats along the Feather and Yuba Rivers would be unlikely. Large flows would be maintained in these rivers that would continue to support aquatic and riparian resources at levels that would exist in the absence of the proposed water transfer. The portion of the Bear River that most likely could be affected by the proposed water transfer has only limited connection with adjacent groundwater that would be pumped. Limited monitoring suggests that little additional loss from the river occurs in response to transfer pumping. Furthermore, there are wetlands, primarily irrigated rice culture, throughout the area and pumping activities reduce groundwater available as part of the wetlands' water supply. However, the amount of water applied for irrigation and the resulting return flows would be largely unchanged under the proposed water transfer condition, relative to the without-transfer condition and would continue to support wetlands (DWR and Reclamation 2003).

As part of the EWA, DWR implements a Well Review process to reduce potential effects upon surface waters. The Well Review may determine that pumping activities should be limited to certain wells, or to a specified depth in some areas, in order to avoid hydraulic interaction between pumping and overlying surface water systems.

Groundwater Quality

Potential groundwater quality effects associated with increased groundwater withdrawals in the North Yuba and South Yuba sub-basins include the migration of reduced quality water. Groundwater underlying Beale Air Force Base on the eastern boundary of the South Yuba sub-basin is contaminated and being remediated (Grinnell 2002 *as cited in* DWR and Reclamation 2003). In addition, high nitrate levels are present in the boundaries of Dry Creek Mutual Water Company (DWR and Reclamation 2003), and the upward migration of saline water from the deeper aquifers is of concern near Wheatland in the southeastern portion of the South Yuba sub-basin. Although plans to supply surface water to this area are in the preliminary planning phase, this area currently relies on groundwater, which may cause the upward migration of saline water (Grinnell 2002 and Aikens 2003 *as cited in* DWR and Reclamation 2003).

With the exception of these areas, groundwater is of good quality with a median total dissolved solids (TDS) concentration of 277 milligrams per liter (mg/L) and 224 mg/L for the North and South Yuba sub-basins, respectively. Groundwater extraction associated with past transfers was a sufficient distance from these problem areas, thus avoiding any adverse groundwater quality effects. Additionally, the Groundwater Program includes monitoring of groundwater quality within the local pumping area.

YCWA has a number of water transfer policies that help guide agency operations. These policies specify that groundwater transfers should not result in unmitigated third party effects, or cause overdraft (Grinnell 2002 *as cited in* DWR and Reclamation 2003). Brown's Valley Irrigation District also has a set of principles and policies addressing groundwater substitution transfers (DWR and Reclamation 2003).

The maximum amount of water for the transfer that would be derived from groundwater substitution is 85,000 acre-feet. Based on the information presented in the Groundwater Analysis (MWH 2005), the extraction of this amount of water will result in conditions that are within an acceptable range for the groundwater basin. Operations of the 2005 groundwater substitution transfer and the projected post-transfer basin conditions will not cause significant or unreasonable impacts to the environment. These expected conditions along with the basin management procedures implemented by YCWA and member districts will result in no significant unmitigated third-party impacts to other groundwater users within the basin. The transfer would not strain the water supply and overall conditions of the Yuba North or Yuba South basins, and will not contribute to, or result in conditions of overdraft.

Groundwater Management

Through previous transfers Yuba County has learned that conjunctive use operations can and sometimes do cause isolated and site-specific effects. If immediate response is provided, significant short term or long term impacts can be avoided completely.

Over the past decade, YCWA and its member districts have taken an active and progressive role in managing the groundwater resources of the sub-basin. YCWA also works with DWR in monitoring the basin and has been instrumental in extending the monitoring network of wells in the basin. Several of the districts in Yuba County have adopted groundwater management plans and YCWA adopted a groundwater management plan (compliant with AB 3030 SB 1938) during February 2005. YCWA and the districts participating in the transfer meet regularly to discuss the management of the basins. As part of basin management, YCWA, DWR, and the member districts have instituted a monitoring plan to record in detail the water levels and water quality of the basins. The monitoring plan will be included in the contract for the transfer with DWR.

The groundwater management approach for groundwater substitution transfers in Yuba County is embodied in three principles as follows:

1. Closely monitor conditions to watch for any potential significant impacts and to gain a better understanding of the groundwater resource;
2. Immediately respond to any significant impacts that occur and mitigate those impacts with appropriate measures; and
3. Utilize the transfer and associated activities to further the goal of effective management of the water resources of Yuba County through conjunctive use of groundwater and surface water.

YCWA and DWR coordinated implementation of the Groundwater Program for the Yuba Sub-basin will protect Yuba County's groundwater resources. Overall no adverse or unreasonable effects upon local groundwater resources would occur related to either water transfer scenario.

South-of-the-Delta Groundwater Banks

DWR may store a portion of the transfer water in groundwater banks located south of the Delta, in the San Joaquin Groundwater Basin. It is likely that groundwater banks would be utilized in 2005 if the water supplied to EWA and requested by SWP contractors does not require delivery of the full proposed transfer amount. Storing excess transfer water in groundwater banks would make storage space available in San Luis Reservoir available for 2006. The water that is stored as groundwater likely would be extracted for use in later years as part of DWR's entitlement or could be conveyed to the California Aqueduct to supplement SWP water supply.

If groundwater basins south of the Delta were used, the amount of water that would be extracted from them would be equivalent to the amount that is deposited. Storage of the transfer water potentially could result in beneficial impacts upon the groundwater basin by increasing groundwater levels, if only temporarily. Eventual extraction of the water potentially could result in groundwater declines, subsidence, or groundwater quality degradation. However, transfer water utilized in the EWA is subject to certain mitigation provisions. Groundwater banking participants have signed MOUs or other agreements that ensure mitigation of potential adverse effects through monitoring and regulation of groundwater declines, subsidence and water quality conditions. Therefore, the proposed water transfer would not be expected to result in unreasonable impacts to South-of-Delta groundwater banks.

4.4 FISHERIES AND AQUATIC RESOURCES

The evaluation of potential impacts on fisheries and aquatic resources due to the proposed temporary water transfer is focused on the reservoirs where operational changes are anticipated, the rivers used for the conveyance of the transfer water, and the Delta. These waterbodies include: (1) storage reservoirs (New Bullards Bar, Oroville, and San Luis); (2) river systems including the Yuba, Feather and Sacramento rivers; and (3) the Delta.

4.4.1 ENVIRONMENTAL SETTING

4.4.1.1 Yuba River

Based on general differences in hydraulic conditions, channel morphology, geology, water conditions, and fish species distribution, Beak (1989) divided the lower Yuba River into the following four reaches:

- **Narrows Reach** – extends from Englebright Dam to the downstream terminus of the Narrows (River Mile [RM] 23.9 to RM 21.9); topography is characterized by steep canyon walls;

- **Garcia Gravel Pit Reach** – extends from the Narrows downstream to Daguerre Point Dam (RM 21.9 to RM 11.5);

- **Daguerre Point Dam Reach** – extends from Daguerre Point Dam downstream to the upstream area of Feather River backwater influence (just east of Marysville) (RM 11.5 to RM 3.5); and

- **Simpson Lane Reach** – begins at the upstream area of Feather River backwater influence and extends to the confluence with the Feather River (RM 3.5 to RM 0).

The lower Yuba River consists of the approximately 24-mile section extending from Englebright Dam, the first impassable fish barrier along the river, downstream to the confluence with the Feather River near Marysville.

The Yuba River provides habitat for Central Valley fall-run Chinook salmon, Central Valley spring-run Chinook salmon (state and federally listed threatened species), Central Valley steelhead (federally listed threatened species), and American shad. Resident fish in the lower Yuba River include rainbow trout, smallmouth bass, largemouth bass, Sacramento sucker, Sacramento pikeminnow, common carp, stickleback, and sculpin (EDAW 2004).

Water temperatures generally are colder upstream of Daguerre Point Dam than downstream of Daguerre Point Dam during the warmer months of the year. Water diversions occur in the vicinity of Daguerre Point Dam, which result in downstream flow reductions primarily during the summer and fall months. Also, during summer months, Yuba River water temperatures progressively warm from the release point downstream of Englebright Dam to the confluence with the Feather River. Yuba River water temperatures generally are cooler than those in the Feather River around the Yuba-Feather river confluence (YCWA 2003a).

The differences in habitat characteristics (e.g., substrates, flows, water temperatures) of the 24 miles of the lower Yuba River suggests a gradient of potential use by adult Chinook salmon and juvenile steelhead. The upper reach represents the best habitat for Chinook salmon spawning and steelhead juvenile rearing, and the lower reach represents the poorest habitat and serves primarily as a corridor for Chinook salmon and steelhead migration.

Anadromous Salmonids in the Yuba River

The timing of the life history events of each fish varies; therefore, at any given time water transfer operations potentially could affect different life stages (e.g., adult immigration and holding, spawning and embryo incubation, and juvenile rearing and downstream movement) of the various salmonids and their habitat (e.g., spawning and rearing habitat).

Chinook Salmon

Fall-run Chinook Salmon

Fall-run Chinook salmon are the most abundant anadromous fish in the lower Yuba River. Central Valley fall-run Chinook salmon support significant sport and commercial fisheries. The fall-run Chinook salmon population in the Yuba River was substantially reduced before the 1950s by extensive mining, agriculture, urbanization, and commercial fishing.

CDFG began making annual estimates of fall-run Chinook salmon spawning escapement in 1953. Construction of the Yuba Project was completed in 1969, and the first annual return of adult Chinook salmon influenced by the completion and operation of the Yuba Project occurred in 1972. From 1953 to 1971, the pre-Yuba Project era, annual return estimates ranged from 1,000 fish in 1957 to 37,000 fish in 1963, and averaged 12,906 fish. Two different estimates of the average annual run of Chinook salmon are available for the post-Yuba Project era: (1) estimates based on carcass counts for all of the reaches; and (2) estimates using an assumed 15.5 percent of the total population contributed by one of the upper reaches of limited access and observational capability, which CDFG used until 1991 when YCWA assumed responsibility for conducting the surveys. From 1972 to 2001, the annual average run of Chinook salmon was 15,361 fish. Using CDFG's traditional 15.5 percent reach-specific estimated contribution to total escapement, the average for the 1972 to 2001 period is 14,560 fish. Thus, since 1972, natural production of fall-run Chinook salmon in the lower Yuba River has been sustained or slightly increased despite continued and increasing out-of-basin stressors that have acted to further limit survival of Chinook salmon in other water bodies, including the lower Sacramento River, Delta and Pacific Ocean.

The fall-run Chinook salmon population in the lower Yuba River is believed to be sustained largely by natural production. Trends in natural production can be masked by large numbers of returning hatchery spawners in rivers with major hatcheries or planting programs, or where significant straying of hatchery fish occurs. No hatchery or long-term planting program exists on the lower Yuba River. Analyses of straying of hatchery Chinook salmon in the Sacramento River Basin indicate a relatively low degree of hatchery spawners stray to the lower Yuba River (Cramer 1991; Cramer 2002).

Fall-run Chinook salmon typically migrate into the lower Yuba River from late September through January, with peak adult migration occurring in late October and November (YCWA 2000). Spawning can begin as early as October 1 (SWRCB 2000 *as cited in* YCWA 2000). Normally, spawning begins in mid-October with peak spawning during November and December (SWRCB 1992 Hearing Exhibit DFG 26, pp. 7 and 62 *as cited in* YCWA 2000). Eggs incubate in the gravel into February, followed by hatching and emergence of fry into March (SWRCB 1992 Hearing Exhibit DFG 26, p. 9 *as cited in* YCWA 2000). Fry may emigrate within a few weeks of emergence while others may rear in-river as late as June before emigrating as smolts (SWRCB 1992 Hearing Exhibit DFG 26, p. 26 *as cited in* YCWA 2000).

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

Spring-run Chinook salmon had virtually disappeared from the Yuba River by 1959 (Fry 1961; Wooster and Wickwire 1970). Major in-basin factors contributing to the decline were migration barriers, hydraulic mining, and water diversions. Hydraulic mining in the Yuba River watershed from 1850 to 1885 caused extensive habitat destruction. Between 1900 and 1941, debris dams constructed by the California Debris Commission and now owned and operated by the Corps on the lower Yuba River to retain hydraulic mining debris, completely or partially blocked the migration of Chinook salmon and steelhead to historic spawning and rearing habitats (Wooster and Wickwire 1970; CDFG 1991; Yoshiyama *et al*. 1996). Spring-run Chinook salmon populations were probably severely affected because of inadequate flows and high water temperatures below the dams during the summer. It is likely that native spring-run Chinook salmon were extirpated during this period. Water diversions also contributed to poor habitat conditions below the dams, especially in dry years. Today, Englebright Dam, completed in 1941 by the California Debris Commission and now owned and operated by the Corps, completely blocks spawning runs of Chinook salmon and steelhead, and is the upstream limit of fish migration.

Since the completion of New Bullards Bar Dam in 1970 by YCWA, higher, colder flows in the lower Yuba River have improved conditions for over-summering and spawning of spring-run Chinook salmon in the lower Yuba River. Small numbers of Chinook salmon that exhibit spring-run characteristics have been observed (CDFG 1998). Although precise escapement estimates are not available, the USFWS testified at the 1992 SWRCB lower Yuba River hearing *"…a population of about 1,000 adult spring-run Chinook salmon now exists in the lower Yuba River*" (SWRCB 1995). In 2001, 108 adult spring-run Chinook salmon were estimated passing the fish ladders at Daguerre Point Dam on the lower Yuba River during March 1 through July 31, possibly representing the early portion of the run. During the month of September 2001, 288 Chinook salmon redds were observed. Historically, September is the peak month of spring-run Chinook salmon spawning, although some temporal overlap with fall-run Chinook salmon exists (CDFG 2002). Neither of these estimates was used to attempt to estimate the total spring-run Chinook salmon escapement in the Yuba River. The origin of these fish and their genetic relationship with fall-run Chinook salmon are unknown. The run may have originated from plants of hatchery-reared spring-run in the lower Yuba River during the 1970s.

No specific information exists on the life history and habitat requirements of spring-run Chinook salmon in the lower Yuba River. Spring-run Chinook salmon cannot be reliably distinguished from fall-run Chinook salmon during spawning and rearing periods because of overlapping spawning periods, juvenile sizes, and other life history traits (YCWA 2000). Reported information on the life history and habitat requirements of Central Valley spring-run Chinook salmon can be found in the *Report to the Fish and Game Commission: A Status Review of the Spring-Run Chinook Salmon* (CDFG 1998) and *Habitat Restoration Actions to Double Natural Production of Anadromous Fish in the Central Valley of California* (USFWS 1995).

Adult spring-run Chinook salmon enter spawning streams from mid-February through July; upstream migration generally peaks in May. Adults continue their migration to summer holding areas where they remain until spawning begins (late August through October). Limited observations by CDFG indicate that adult spring-run Chinook salmon may migrate into the lower Yuba River from March through June and spend the summer in deep pools in the Narrows Reach (Beak 1989). Spring-run Chinook salmon typically spawn from late August through October, although spawning occurs later at lower elevations. In the lower Yuba River, the earliest that Chinook salmon redds have been observed in the Garcia Gravel Pit Reach (primarily above Parks Bar) has been mid-September (CDFG 2000 *as cited in* YCWA 2000). Little spawning habitat exists upstream of the major summer holding area (Narrows Reach). Egg incubation and fry emergence generally occur from September through January (YCWA 2000).

Chinook Salmon Utilization of Yuba River During Proposed Transfer Period

Both spring-run and fall-run adult Chinook salmon, and particularly spring-run, may immigrate into their spawning grounds, including the lower Yuba River, during the proposed water transfer period (June through October). Some spring-run Chinook salmon may begin spawning in September. Fall-run Chinook salmon generally enter the Yuba River from September through November. Adult Chinook salmon of hatchery origin have been observed in the lower Yuba River during non-transfer years, and monitoring efforts at the fish ladders of Daguerre Point Dam before and during the 2001, 2002 and 2003 water transfers showed a number of adult Chinook salmon of hatchery origin ascending the lower Yuba River during the water transfers (Navicky 2004 *as cited in* SWRI 2005; YCWA 2003a as *cited in* SWRI 2005).

Chinook salmon juveniles are less likely to be affected by YCWA water transfers than Chinook salmon adults. Juvenile fall-run Chinook salmon are believed to emigrate shortly after emergence (Moyle 2002) and thus are not likely to be subjected to water transfer river conditions. Juvenile fall-run Chinook salmon usually spend very little time in their natal rivers, emigrating in large numbers as small fry during winter (CDFG 2000). The relatively few remaining Chinook salmon juveniles emigrate as smolts from April through June. Although it has been suggested that juvenile spring-run Chinook salmon may exhibit some extended rearing above Daguerre Point Dam, juvenile Chinook salmon have infrequently been observed or captured during the summer in the lower Yuba River. Recent unpublished CDFG rotary screw trap (RST) catch data collected from 1999 through 2002 in the lower Yuba River (Hallwood Boulevard, RM 7) indicate that approximately 98 percent of the Chinook salmon juveniles caught by the RST during the surveying season (November 1 through July 1) had been caught by April 21 (YCWA 2003b). Therefore, the majority of juvenile Chinook salmon are expected to have emigrated prior to the initiation of the proposed water transfer, and flow changes associated with the proposed water transfer would not be expected to adversely affect juvenile Chinook salmon rearing.

Steelhead

Historical information on Central Valley steelhead populations is limited. Steelhead ranged throughout accessible tributaries and headwaters of the Sacramento and San Joaquin rivers before major dam construction, water development, and other watershed disturbances. Many of the freshwater habitat factors cited for declines in spring-run Chinook salmon generally apply to steelhead as well, because of their need for tributaries and headwater streams where cool, well-oxygenated water is available year-round. Historical declines in steelhead abundance have been attributed largely to dams that eliminated access to most of their historic spawning and rearing habitat, and restricted steelhead to less suitable habitat below the dams. Other factors that have contributed to the decline of steelhead and other salmonids include habitat modification, over-fishing, disease and predation, inadequate regulatory mechanisms, climate variation, and artificial propagation (NMFS 1996).

CDFG estimated that only approximately 200 steelhead spawned in the lower Yuba River before New Bullards Bar Reservoir was completed in 1969. From 1970 to 1979, CDFG annually stocked 27,270 to 217,378 fingerlings, yearlings, and sub-catchables from Coleman National Fish Hatchery into the lower Yuba River (CDFG 1991). Based on angling data, CDFG estimated a run size of 2,000 steelhead in the lower Yuba River in 1975. The current status of this population is unknown, but it appears to be stable and able to support a significant sport fishery (McEwan and Jackson 1996). The Yuba River is currently managed for natural steelhead production (CDFG 1991).

The immigration of adult steelhead in the lower Yuba River has been reported to occur from August through March, with peak immigration from October through February (CDFG 1991). Therefore, immigrating adult steelhead are less likely to be affected by YCWA water transfers than immigrating adult Chinook salmon. Juvenile steelhead often rear in the Yuba River for one year or more and, therefore, will be rearing throughout the proposed water transfer period.

American Shad

Adult American shad typically enter Central Valley streams from April through early July (CDFG 1986), with the spawning migration peaking from mid-May through June (CDFG 1987). Water temperature is an important factor influencing the timing of spawning. Spawning takes place mostly in the main channels of rivers, and generally about 70 percent of the spawning run is made up of first time spawners (Moyle 2002). In contrast to salmonids, distributions of spawning American shad are determined by river flow rather than homing behavior (Painter *et al*. 1979). When suitable spawning conditions are found, American shad school and broadcast their eggs throughout the water column. Egg incubation and hatching are coincident with the primary spawning period, May to June.

Adult American shad are typically in the Yuba River in late May and June. The water transfer would have no unreasonable effects on American shad because the transfer water would be released after most shad have left the Yuba River (EDAW 2004).

Summary of Recent Water Transfer Fisheries Monitoring Studies and Findings

The Yuba River is one of many Central Valley rivers utilized in water transfer projects for a number of years. The following discussion provides a summary of YCWA's water transfers and related monitoring studies and evaluations performed in 2001, 2002, and 2004. Monitoring studies were not conducted in 2003 because a research permit authorizing take of federally listed species, as required by Section 10 of the federal ESA, was not issued. It is anticipated that the proposed 2005 water transfer would be conducted in a manner similar to the 2002 and 2004 transfers. As described in Section 8.0, Consultation and Coordination, YCWA has participated in two coordination meetings with the fisheries resource agencies, CDFG, NMFS, and USFWS, and will continue to consult with these agencies regarding the proposed 2005 water transfer.

In 2001, 2002, 2003 and 2004, YCWA and other local water agencies initiated water transfers from New Bullards Bar Reservoir through the Yuba River to satisfy a variety of downstream water needs. YCWA water transfer amounts and periods were as follows:

Year	Acre-feet	Transfer Period
2001	172,000 acre-feet	July 1 through mid-October 2001
2002	157,050 acre-feet	Mid-June through mid-September 2002
2003	65,000 acre-feet	Mid-July through mid-October 2003
2004	100,487 acre-feet	July 1 through September 28, 2004

The primary fisheries issues evaluated in recent water transfer monitoring and evaluation studies include: (1) juvenile steelhead downstream movement; (2) adult Chinook salmon immigration and the potential for increased straying of non-native fish into the Yuba River; and (3) water temperatures in the lower Yuba River and Feather River.

Juvenile steelhead and adult Chinook salmon were monitored during 2001, 2002 and 2004 Yuba River water transfers utilizing RSTs and adult ladder trapping (in June 2003, an automated fish detection system was installed at the Daguerre Point Dam fish ladders to improve the overall efficiency of adult Chinook salmon monitoring). Due to the differences in the characteristics of the water transfers (i.e., a distinct ramp-up period in 2001 but not in 2002 or 2004), patterns of juvenile steelhead downstream movement that were observed in 2001 were not similar to those observed in 2002 or 2004. Additionally, monitoring program complications and inherent natural variation between 2001, 2002, and 2004 (associated with water year type and the abundance, timing and distribution of juvenile steelhead, among other parameters) complicate the use of the observations to draw definitive conclusions regarding the effects of water transfers on juvenile steelhead in the lower Yuba River. However, the studies and evaluation undertaken in 2004 provide an assessment of potential short-term effects of the 2004 water transfers on Yuba River fisheries (specifically regarding juvenile steelhead movement and adult Chinook salmon immigration).

Discussions among YCWA and fisheries resources agencies (i.e., CDFG, USFWS and NMFS) resulted in modification of the operations associated with the 2004 water transfer. Specifically, CDFG suggested several measures to avoid adverse impacts upon anadromous fish resources of the lower Yuba River. In response to these discussions, YCWA maintained minimum instream flow levels to avoid substantial increases or decreases in lower Yuba River flow at the initiation of the 2004 water transfers. Additionally, YCWA operated such that any changes in flow were gradual. Also, as requested by CDFG, the monitoring and evaluation studies of lower Yuba River fisheries conducted in 2002 were continued in 2004.

The initial observations and reported findings of the monitoring and evaluations studies undertaken during 2001, 2002 and 2004 are summarized below.

Juvenile Steelhead Downstream Movement

Juvenile steelhead rear in the Yuba River year-round. Therefore, water transfers during the summer and early fall potentially may affect their behavior. Resource agencies involved in the management of fisheries resources in the lower Yuba River have indicated concern that YCWA water transfers potentially can induce downstream movement of juvenile steelhead due to increases in instream flows associated with water transfer operations. Downstream movement may transport juvenile steelhead into less suitable habitat of the lower Yuba or Feather rivers. The potential movement of juvenile steelhead over Daguerre Point Dam (RM 11) restricts subsequent rearing to those areas downstream of Daguerre Point Dam, because juvenile steelhead are not able to readily pass back upstream of Daguerre Point Dam. Conditions downstream of Daguerre Point Dam may be more or less suitable for juvenile steelhead rearing during the post-water transfer period, depending upon several factors, including post-water transfer water temperatures as influenced by ambient conditions.

This section summarizes the observations made based upon monitoring and evaluation studies implemented for the 2001, 2002 and 2004 YCWA water transfers. It is noted that due to differences in monitoring program implementation during these years of study, it is problematic to conclude definitive trends from the data. However, based upon the substantial differences in juvenile steelhead downstream movements (RST catch data) noted between the 2001, and the 2002 and 2004 studies, it does appear that the increase in juvenile steelhead downstream movement associated with the initiation of the 2001 water transfers was avoided with a more gradual ramping-up of flows, as conducted in 2002 and 2004.

The 2001 water transfer was characterized by a relatively large, rapid ramp-up period. Beginning approximately July 1, 2001, water transfers increased flows in the lower Yuba River over a few days by about 1,200 cfs and generally were sustained through late August when ramping down began. On July 8, 2001, a week subsequent to the start of the 2001 water transfers, the daily catch at the CDFG Hallwood Boulevard (RM 7) RST, increased from less than ten young-of-the-year (YOY) steelhead juveniles per day, to more than 450 YOY per day (CDFG unpublished data). The next week, daily catches decreased to about 190 YOY per day. In the following weeks, while the transfers were continuing, daily catches decreased further, but still surpassed catches prior to the water transfers. Thus, potentially associated with the ramping-up of the 2001 water transfers, juvenile steelhead moved downstream from the upstream reaches of the lower Yuba River to areas downstream of Hallwood Boulevard. The relationship between a rapid increase in flow and a large peak in the number of juvenile steelhead captured at the RSTs may indicate the water transfer affected downstream movement of juvenile steelhead, possibly over Daguerre Point Dam into the lower Yuba River, or into the lower Feather River.

In response to the 2001 water transfer observations and discussions regarding flow and water temperature patterns and coincident fish behavior, including juvenile steelhead downstream movement, YCWA, NMFS, USFWS, CDFG and non-governmental organization (NGO) representatives collaboratively developed a rigorous monitoring and evaluation plan for YCWA water transfers. Additionally, these entities created an instream flow release schedule for the water transfers to avoid a rapid increase in flow when the transfers begin to minimize or avoid impacts upon anadromous fish in the lower Yuba River.

During the 2002, 2003, and 2004 water transfers, YCWA operated the Yuba Project in a manner that maintained instream flows in the lower Yuba River at a relatively stable rate in the late spring, with gradual changes in flow rates through initiation of the water transfer. Maintenance of more stable and gradually changing flows during this period (June through July), rather than a large, rapid ramp-up as characterized the 2001 water transfer, appeared to minimize the potential for transfer-related inducement of juvenile salmonid downstream movement.

Monitoring data (RST catch data) for 2002 and 2004 water transfers indicate that the large peak in downstream movement of juvenile steelhead observed in 2001 did not occur in 2002 or 2004. During the 2002 water transfer evaluation, the abundances and the temporal distributions of juvenile steelhead passing Daguerre Point Dam and Hallwood Boulevard were estimated. In addition, several observations were made regarding the possible relationship between juvenile steelhead downstream movement and flow, water temperature, and the initiation, ramping-down and termination of the 2002 water transfers. The RST catch data from the 2002 water transfers do not suggest an association between the initiation of the water transfers and the downstream movement of juvenile steelhead. This information suggests that the large increase in the numbers of juvenile steelhead moving downstream at the initiation of the 2001 transfers may be avoided by maintaining a more gradual increase in flows through the initiation of water transfers. Downstream movement of juvenile steelhead during the water transfers may be associated with the rate of flow increase from the water transfer, rather than the eventual maximum flow or a response to water temperature change. In 2004, neither the RST catch data nor the estimated abundances suggest an association between the initiation of the water transfers and the downstream movement of juvenile steelhead.

The juvenile steelhead catch data from the 2002 water transfers suggest a site-specific variation in the relationship between juvenile steelhead downstream movement (both timing and abundance), and the ramping-down of transfer flows. During the 2002 extended ramping-down period (31 days), the number of juvenile steelhead moving downstream from upstream of Daguerre Point Dam decreased considerably relative to the number of juvenile steelhead moving downstream during the preceding period of relatively high and stable flows. It appears that juvenile steelhead ceased movement past Daguerre Point Dam concurrently with the down-ramping of the water transfers. By contrast, the largest numbers of juvenile steelhead moved downstream past Hallwood Boulevard during the ramp-down period. However, this peak is not clearly associated with the flow ramp-down initiation, but may be more closely related to the subsequent increase in water temperatures. Hence, it appears that the juvenile steelhead responses to the down-ramping of flows associated with the 2002 water transfers may differ by river reach.

The 2004 Yuba River water transfers were characterized by a significantly shorter ramping-down period (5 days) than the 2002 water transfers. Unlike the 2002 observations, the 2004 data did not indicate a site-specific variation in the relationship between juvenile steelhead downstream movement (both timing and abundance) and the ramping-down of transfer flows. The number of juvenile steelhead moving past the three RST sites decreased during the ramping down of flows.

During both 2002 and 2004, a greater number of steelhead juveniles moved past the Daguerre Point Dam RST relative to the Hallwood Boulevard RST location. Statistical evaluation of the 2002 and 2004 data indicate that the percentage of fish moving downstream past these locations was not significantly different between the two years of data (SWRI 2005). During the 2002 water transfers investigations, the estimated abundance of juvenile steelhead passing the Daguerre Point Dam RST significantly exceeded the estimated abundance passing the Hallwood Boulevard RST (by approximately 80,000 fish), which may or may not have been associated with the water transfers and/or the presence of Daguerre Point Dam. However, the results of the 2002 water transfers study did not have sufficient resolution to determine the reasons for the significant difference in abundance estimates between monitoring sites, and the experimental design did not allow for determination of the fate of the fish that moved passed the Daguerre Point Dam RSTs. Potential losses of fish may be attributed to mortality encountered while passing the Daguerre Point Dam, diversion of fish through the Hallwood-Cordua diversion canal, or mortality or residualization within the middle Yuba River study reach (between upstream and downstream RST locations) (SWRI 2005).

In an effort to collect information intended to isolate the potential effects of the Daguerre Point Dam infrastructure (including diversions) and provide clarification for the difference between the estimated abundances of steelhead juveniles moving past the Daguerre RST and the Hallwood RST during the 2002 water transfers study, the 2004 study included relocation of one of the Daguerre Point Dam RSTs to the third riffle downstream of Daguerre Point Dam, at Kibbe Road (RM 9.0). Additionally, statistical analyses related to abiotic parameters and the operation of the RSTs were conducted to evaluate the operation and efficiency of the RSTs.

Based on the statistical evaluation of 2004 abundance estimates for the Daguerre Point Dam and Hallwood Boulevard RSTs, it appears that the numbers of juvenile steelhead moving downstream from the Daguerre Point Dam RST past the Hallwood Boulevard RST (approximately four miles) may be affected more (in terms of percentage of fish) by conditions encountered in the 2-mile reach between the Kibbe Road RST and the Hallwood Boulevard RST, than by conditions in the 2.5-mile reach between the Daguerre RST and the Kibbe RST, including the Daguerre Point Dam infrastructure. However, this does not suggest that the Daguerre Point Dam infrastructure and diversions do not affect the abundance, survival and movement of juvenile steelhead.

The 2004 temporal distributions of daily steelhead catch at the Daguerre, Kibbe and Hallwood RSTs showed an alternation of modes occurring on roughly similar dates at the three sites. The trimodal temporal distribution of daily steelhead catches at the Daguerre RST and the bimodal temporal distributions of daily steelhead catches at the Kibbe and Hallwood RSTs, and their oscillatory patterns, do not appear to be directly related to the daily distributions of flow or water temperature. Possibly, the observed pattern is a reflection of a migratory response of steelhead juveniles to an external environmental cue. Juvenile steelhead movement may potentially be prompted by the lunar cycle. At the three RSTs, the lowest daily catches of juvenile steelhead appeared to coincide with a full moon. Moreover, the magnitude of juvenile steelhead catch appears to have increased when the moon was in its waning phases and decreased when the moon was in its waxing phases. Several other studies (e.g., Roper and Scarnecchia 1999; S.P. Cramer and Associates 2000; Healey 1991) have suggested an association between downstream movement of juvenile salmonids and lunar cycle (SWRI 2005).

A comprehensive literature review was conducted to establish biologically defensible water temperature index values to be used as guidelines for assessing potential effects on the steelhead juvenile rearing and downstream movement life stage for the "*Evaluation of the 2004 Yuba River Water Transfers.*" Multiple water temperature index values were established to reflect an evenly spaced distribution of index values that range from reported "optimal" to "lethal" water temperatures. Water temperature index values were determined by placing emphasis on the results of laboratory experiments and field studies that examined how water temperatures affect Central Valley juvenile steelhead rearing and downstream movement, as well as by considering regulatory documents such as biological opinions from NMFS. Experiments and studies conducted using fish from outside the Central Valley were used to establish index values when local studies were unavailable. To avoid unwarranted specificity, only whole integers were selected as index values — thus, support for index values was, in some cases, partially derived from literature supporting a water temperature that varied from the resultant index value by several tenths of a degree.

The duration of freshwater residence for juvenile steelhead is long relative to that of Chinook salmon, making the juvenile life stage of steelhead more susceptible to the influences of water temperature, particularly during the over-summer rearing period. Water temperature index values of 65°F, 68°F, 72°F, and 75°F were established to represent a relatively evenly distributed range of index values for juvenile steelhead rearing and downstream movement (**Table 2**).

The lowest water temperature index value of 65°F was established because NMFS (2002) reported 65°F as the upper limit preferred for growth and development of Sacramento and American River juvenile steelhead. Also, 65°F was found to be within the preferred water temperature range (i.e., 62.6°F to 68.0°F) and supported high growth of Nimbus strain juvenile steelhead (Cech and Myrick 1999). Cherry *et al*. (1977) and Kaya *et al*. (1977) both observed an upper preference water temperature near 68.0°F for juvenile rainbow trout, duplicating the upper preferred limit for juvenile steelhead observed in Cech and Myrick (1999). Because of the literature supporting 68.0°F as the upper preferred limit for juvenile *Oncorhynchus mykiss*, 68°F was established as a water temperature index value. A water temperature index value of 72°F was established because symptoms of thermal stress in juvenile steelhead have been reported to arise at water temperatures approaching 72°F. For example, physiological stress to juvenile steelhead in Northern California streams was demonstrated by increased gill flare rates, decreased foraging activity, and increased agonistic activity as stream temperatures rose above 71.6°F (Nielsen *et al*. 1994). Also, 72°F was selected as a water temperature index value because 71.6°F has been reported as an upper avoidance water temperature (Kaya *et al*. 1977) and an upper thermal tolerance water temperature (Ebersole *et al*. 2001 *in* EPA 2002) for juvenile rainbow trout. The highest water temperature index value of 75°F was established because NMFS and EPA report that direct mortality to rearing juvenile steelhead results when stream temperatures reach 75.0°F (EPA 2002; NMFS 2001).

Table 2. Juvenile steelhead rearing and downstream movement water temperature index values and the literature supporting each value.

Index Value	Supporting Literature
65°F	Upper limit of 65°F preferred for growth and development of Sacramento River and American River juvenile steelhead (NMFS 2002); Nimbus juvenile steelhead growth showed an increasing trend with water temperature to 66.2°F, irrespective of ration level or rearing temperature (Cech and Myrick 1999); The final preferred water temperature for rainbow fingerlings was between 66.2 and 68°F (Cherry *et al*. 1977); Nimbus juvenile steelhead preferred water temperatures between 62.6°F and 68.0°F (Cech and Myrick 1999); Rainbow trout fingerlings preferred or selected water temperatures in the 62.6°F to 68.0°F range (McCauley and Pond 1971).
68°F	Nimbus juvenile steelhead preferred water temperatures between 62.6°F and 68.0°F (Cech and Myrick 1999); The final preferred water temperature for rainbow trout fingerlings was between 66.2°F and 68°F (Cherry *et al*. 1977); Rainbow trout fingerlings preferred or selected water temperatures in the 62.6°F to 68.0°F range (McCauley and Pond 1971); The upper avoidance water temperature for juvenile rainbow trout was measured at 68°F to 71.6°F (Kaya *et al*. 1977).
72°F	Increased physiological stress, increased agonistic activity, and a decrease in forage activity in juvenile steelhead occur after ambient stream temperatures exceed 71.6°F (Nielsen *et al*. 1994); The upper avoidance water temperature for juvenile rainbow trout was measured at 68°F to 71.6°F (Kaya *et al*. 1977); Estimates of upper thermal tolerance or avoidance limits for juvenile rainbow trout (at maximum ration) ranged from 71.6°F to 79.9°F (Ebersole *et al*. 2001 *in* EPA 2002).
75°F	The maximum weekly average water temperature for survival of juvenile and adult rainbow trout is 75.2°F (EPA 2002); Rearing steelhead juveniles have an upper lethal limit of 75.0°F (NMFS 2001); Estimates of upper thermal tolerance or avoidance limits for juvenile rainbow trout (at maximum ration) ranged from 71.6 to 79.9°F (Ebersole *et al*. 2001 *in* EPA 2002).

The number of days that lower Yuba River water temperatures reached or exceeded each of the index values at each of the Yuba River sites sampled from May 1 through October 1, 2004 serve as an indicator of the suitability of lower Yuba River water temperatures for juvenile steelhead rearing and downstream movement. Daily average water temperatures in the lower Yuba River at Daguerre Point Dam (RM 11) and at Marysville (RM 6) did not exceed the 65°F, 68°F, 72°F, or 75°F water temperature index values for steelhead juvenile rearing and downstream movement during the entire 2004 study period and, thus, were consistently within the range considered to be suitable. Additionally, although water temperature is known to affect juvenile salmonid distribution, movement, growth and survival, it cannot be concluded, based on the data collected, that differences in water temperature between Daguerre Point Dam and Marysville can explain the large differences in the abundance estimated at the three RST locations monitored in 2004.

Although water temperatures in the lower Yuba River were consistently within the range considered suitable for steelhead juvenile rearing and downstream movement during the 2004 RST monitoring period, Feather River water temperatures downstream of the confluence with the Yuba River commonly were not. For example, daily average water temperatures in the Feather River (measured at the left bank, four miles downstream from the Yuba River confluence) exceeded the 65°F water temperature index value for steelhead juvenile rearing and downstream movement on 35 occasions (81.4 percent) during the pre-transfer period, on 63 occasions (100 percent) during the transfer period, and on 17 occasions (56.7 percent) during the post-transfer period. Additionally, daily average water temperatures at this location exceeded the 68°F water temperature index value on 25 occasions (58.1 percent) during the pre-transfer period, on 11 occasions (17.5 percent) during the transfer period, and on no occasions during the post-transfer period. However, daily average water temperatures never exceeded the 72°F or 75°F water temperature index values.

Three potential factors may explain the large differences in the estimated total number of juvenile steelhead passing each of the three RST locations. First, juvenile steelhead moving from upstream of the Daguerre Point Dam may experience relatively high mortality rates at Daguerre Point Dam and in the river reaches between Daguerre Point Dam and Kibbe Road, as well as between Kibbe Road and Hallwood Boulevard. Although some proportion of the emigrating juvenile steelhead population likely suffered mortality from factors such as predation, disease, natural mortality, and entrainment, it is unlikely that factors such as these alone are able to explain the large observed difference in estimated total abundance between the Daguerre, Kibbe, and Hallwood RSTs. Also, the potential contribution of in-river, natural mortality resulting from water temperature is not likely high because, as discussed above, water temperatures in the lower Yuba River between Daguerre Point Dam (RM 11) and Marysville were consistently within a range considered suitable for juvenile steelhead rearing during the 2004 study period.

Second, juvenile steelhead moving past the Daguerre RSTs may not have moved past the Kibbe and Hallwood RSTs before the end of the sampling period. The multi-modal temporal distributions of daily RST catches observed in 2002 and 2004 suggest a periodic variation in the magnitude of downstream moving steelhead in response to some environmental cue (e.g., out-migration prompted by changes in lunar cycles). Also, the habitats between the Daguerre RST and the Hallwood RST may be conducive to rearing, and juvenile steelhead may have temporarily taken up residence in this reach, thus potentially avoiding capture in the Kibbe or Hallwood RST during the study period.

Third, the difference in abundance estimates between the Daguerre and Hallwood Boulevard RST locations also may be partially explained by sampling and analytical error. Differences in RST operations and the placement of the RSTs within the hydraulic spectrum of the river potentially may have caused discrepancies in catch between the traps. For example, slight variations in the capture efficiency tests caused by dissimilarities in the local hydrology where the tests were conducted could produce large differences in capture efficiencies which, in turn, could affect the estimation of the total abundance at each trap location.

It is important to note that the above discussion does not attempt to describe causal relationships, and instead only discusses the potential relationships between abiotic and biotic factors in the lower Yuba River during the 2002 and 2004 water transfers. The analysis of only two years of quantifiable and calibrated RST capture data, in conjunction with one year of uncalibrated RST catch trends, is not sufficient to definitively determine the foundations of the biologic responses of juvenile steelhead to changes in flow and water temperature.

In summary, water transfers monitoring in 2001, 2002 and 2004 indicate that the character of the initiation of the water transfers potentially can affect juvenile steelhead downstream movement. In 2001, an increase in the number of downstream moving juvenile steelhead was observed coincident with the relatively rapid and large increase in streamflow at the onset of the water transfer. However, in 2002 and 2004, when increases in streamflow during the initiation of the water transfers were relatively small and gradual, increases in the numbers of downstream moving juvenile steelhead were not observed.

Adult Chinook Salmon Immigration

In the past, hypotheses have been suggested regarding the potential relationships between the water transfers and the relative abundance of adipose fin-clipped and non-adipose fin-clipped immigrating adult Chinook salmon. Specifically, concern has been raised regarding the potential for the Yuba River water transfers *via* decreased water temperatures and increased proportions of flow, relative to the Feather River, to encourage non-natal Feather River hatchery Chinook salmon to stray into the Yuba River. YCWA and CDFG monitoring efforts in 2001, 2002, 2003, and 2004 water transfer years indicated that Chinook salmon of hatchery origin ascended the fish ladders at Daguerre Point Dam in the lower Yuba River during both the water transfer and non-transfer periods. Chinook salmon of hatchery origin also have been observed ascending the Yuba River in non-transfer years (CDFG unpublished data).

Adult Chinook salmon monitoring study results during the 2001 and 2002 water transfers potentially indicated some correspondence with water temperatures, suggesting that the cooler water temperatures potentially associated with the water transfers may have encouraged some straying of non-native adult Chinook salmon into the Yuba River. However, because only the 2002 data was statistically analyzed, the reliance upon only one year of data restricted the confidence in, and overall applicability of, such a tentative conclusion. Further, a number of unexpected procedural difficulties were encountered during the 2002 study implementation leading to unequal distribution of sampling effort at the fish ladders and low number of sampling days representing the water transfer study period (i.e., less than 15 percent of the study period). These issues, combined with the incorrect assumption that salmon counts before, during and after the water transfers were distributed as Poisson variables with constant but distinct rates[4], likely lead to underestimation of adult Chinook salmon abundance. However, despite the

[4] A Chi-square analysis indicated that during the 2004 survey, neither the adipose fin-clipped or the non-adipose fin-clipped Chinook salmon migrated with constant but distinct rates for the pre-transfer, transfer, and post-transfer periods, suggesting that the assumption that salmon counts before, during and after the water transfers were distributed as Poisson variables with constant but distinct rates, that was used to estimate the 2002 abundance of adipose fin-clipped and non-adipose fin-clipped Chinook salmon, probably was incorrect.

procedural difficulties and low reliability of the resulting abundance estimates, the 2002 study led to three general observations.

1) The temporal distribution of the combined adult Chinook salmon catch, displaying a large increase in catch coincident with the decreases in flow and increases in water temperature associated with the ramp-down of the water transfers, was more likely a reflection of the adult immigration life stage periodicity expected for fall-run Chinook salmon. Fall-run Chinook salmon typically begin entering the upstream portions of the lower Yuba River in increasing numbers during the late-summer and early fall months (coinciding with the 2002 post-transfer period). Chinook salmon displaying spring-run Chinook salmon life history characteristics in the lower Yuba River generally begin entering the lower Yuba River, in much fewer numbers than fall-run Chinook salmon, at an earlier time that coincided with the 2002 pre-transfer and transfer periods.
2) The 2002 immigration rates for non-adipose fin-clipped adult Chinook salmon suggested that the relatively high water transfer flows did not attract salmon immigrants because otherwise a greater immigration rate would have been observed during the transfer period relative to the pre- and post-transfer periods.
3) The estimates of the proportions of adipose fin-clipped adult Chinook salmon to the total number of adult Chinook salmon immigrating into the lower Yuba River before, during and after the 2002 water transfers did not necessarily indicate the attraction of non-natal (adipose fin-clipped) adult Chinook salmon during the transfer period because the calculated proportions were based on the abundance and immigration rate estimates for the periods under comparison that were not fully reliable, particularly for adipose fin-clipped adult Chinook salmon.

In June 2003, the VAKI RiverWatch system (VAKI), an infrared and video graphic device used to classify and enumerate adult fish, was installed at the Daguerre Point Dam fish ladders. During the 2004 study period (May 1 through September 30, 2004), the VAKI was utilized to monitor migration pattern and abundance estimates of adipose fin-clipped and non-adipose fin-clipped adult Chinook salmon immigrating into the lower Yuba River before, during and after the 2004 water transfer. The use of the VAKI as a counting device, and CDFG's processing of the resulting VAKI counts, photographs, and silhouettes enabled a more efficient and reliable collection of data than in 2002. The data were used to obtain estimates of the immigration rates (fish/day), abundance estimates of adipose fin-clipped and non-adipose fin-clipped adult Chinook salmon, and proportions of adipose fin-clipped adult Chinook salmon. The resulting data set permitted intense statistical evaluation including Chi-square analysis, multiple regression analysis and multivariate time series analysis, providing a more thorough assessment of the potential effects of the 2004 water transfer on the immigration of Chinook salmon into the lower Yuba River, and of the relationship between Chinook salmon immigration and Yuba River flows and water temperatures, relative to the Feather River, than could be performed in previous years. The findings of these analyses led to the following several general conclusions.

- The temporal distributions of the daily counts of adipose fin-clipped and non-adipose fin-clipped adult Chinook salmon likely were reflections of Chinook salmon adult immigration life stage periodicity, with the relatively abundant fall-run Chinook salmon mostly migrating during the post-transfer period.

- As the 2004 study period progressed, more adipose fin-clipped and non-adipose fin-clipped Chinook salmon were observed immigrating into the Yuba River, but not necessarily resulting from an attraction to the cooler waters of the Yuba River or to a relative increase in Yuba River flows with respect to the Feather River flows. The 2004 abundance estimates and immigration rates for adipose fin-clipped and non-adipose fin-clipped adult Chinook salmon suggest that the relatively high flows and low water temperatures observed during the transfer period did not necessarily attract salmon immigrants; otherwise, greater abundances and immigration rates would have been observed during the transfer period relative to the pre- and post-transfer periods.
- The estimates of the proportions of clipped adult Chinook salmon to the total number of adult Chinook salmon immigrating into the lower Yuba River did not suggest the attraction of non-natal adult Chinook salmon during the 2004 transfer period, because the proportion calculated for the transfer period was not greater than the proportions for the pre-transfer and post-transfer periods.
- Multivariate time series analyses indicate that the immigration rates of non-adipose fin clipped and adipose-fin clipped Chinook salmon in 2004 are not significantly associated with: (1) attraction flows, defined as the difference between Yuba River and Feather River flows; or (2) attraction water temperatures, defined as the difference between Yuba River and Feather River water temperatures.
- Analyses of the 2002 and 2004 water transfers studies data indicate that water transfers that do not involve a large, rapid ramp-up and that are characterized by relatively high and stable flows (between 1,000 cfs (2004) and 1,400 cfs (2002)) during July and August), do not appear to attract non-natal adult Chinook salmon into the Yuba River.

Water temperature index values were established for Chinook salmon adult immigration and holding. The water temperature index values established to evaluate the potential effects of the water temperatures associated with the water transfers on Chinook salmon adult immigration and holding life stage are 60°F, 64°F, and 68°F (**Table 3**). Although 56°F is referenced in the literature frequently as the upper "optimal" water temperature limit for the upstream migration and holding of Chinook salmon, the references are not foundational studies and often are inappropriate citations. For example, many of the references to 56°F are based on Hinze (1959), which is a study examining the effects of water temperature on incubating Chinook salmon eggs. Boles *et al*. (1988), Marine (1992), and NMFS (1997) all cite Hinze (1959) in support of recommendations for a water temperature of 56°F for adult Chinook salmon immigration. Because 56°F is not strongly supported in the literature for adult Chinook salmon immigration and holding, it was not established as an index value.

Table 3. Chinook salmon adult immigration and holding water temperature index values and the literature supporting each value.

Index Value	Supporting Literature
60°F	Maximum water temperature for adults holding, while eggs are maturing, is approximately 59ºF to 60ºF (NMFS 1997); Acceptable water temperatures for adults migrating upstream range from 57ºF to 67ºF (NMFS 1997); Upper limit of the optimal water temperature range for adults holding while eggs are maturing is 59°F to 60°F (NMFS 2000); Many of the diseases that commonly affect Chinook salmon become highly infectious and virulent above 60ºF (ODEQ 1995); Mature females subjected to prolonged exposure to water temperatures above 60°F have poor survival rates and produce less viable eggs than females exposed to lower water temperatures (USFWS 1995).
64°F	Acceptable range for adults migrating upstream is from 57ºF to 67ºF (NMFS 1997); Disease risk becomes high at water temperatures above 64.4°F (EPA 2003); Latent embryonic mortalities and abnormalities associated with water temperature exposure to pre-spawning adults occur at 63.5ºF to 66.2°F (Berman 1990); Spring-run Chinook salmon embryos from adults held at 63.5ºF to 66.2°F had greater numbers of pre-hatch mortalities and developmental abnormalities than embryos from adults held at 57.2ºF to 59.9°F (Berman 1990).
68°F	Acceptable range for adults migrating upstream range from 57°F to 67ºF (NMFS 1997); For chronic exposures, an incipient upper lethal water temperature limit for pre-spawning adult salmon probably falls within the range of 62.6°F to 68.0°F (Marine 1992); Water temperatures of 68°F resulted in nearly 100 percent mortality of Chinook salmon during columnaris outbreaks (Ordal and Pacha 1963).

The lowest water temperature index value established was 60°F because, in the NMFS biological opinion for the proposed operation of the Central Valley Project and State Water Project, 59°F to 60°F is reported as "…*The upper limit of the optimal temperature range for adults holding while eggs are maturing*" (NMFS 2000). Also, NMFS (1997) states "…*generally, the maximum temperature of adults holding, while eggs are maturing, is about 59°F to 60°F…*" and "…*acceptable range for adults migrating upstream range from 57°F to 67°F*." ODEQ (1995) reports that "…*many of the diseases that commonly affect Chinook become highly infectious and virulent above 60°F*." An index value of 64°F was established because Berman (1990) suggests effects of thermal stress to pre-spawning adults are evident at water temperatures near 64°F. Berman (1990) conducted a laboratory study to determine if pre-spawning water temperatures experienced by adult Chinook salmon influenced reproductive success, and found evidence suggesting latent embryonic abnormalities associated with water temperature exposure to pre-spawning adults occurs at 63.5°F to 66.2°F. Also, 64°F represents a mid-point value between the water temperature index values of 60°F and 68°F. An index value of 68°F was established because the literature suggests that thermal stress at water temperatures greater than or equal to 68°F is pronounced, and severe adverse effects to immigrating and holding pre-spawning adults, including mortality, can be expected (Berman 1990; Marine 1992; NMFS 1997). Because significant impacts to immigrating and holding adult Chinook salmon reportedly occur at water temperatures greater than or equal to 68°F, index values higher than 68°F were not established.

The number of days that lower Yuba River water temperatures reached or exceeded each of these index values at each if the Yuba River sites sampled from May 1 through October 1, 2004 serves as an indicator of the suitability of lower Yuba River water temperatures for Chinook salmon adult immigration and holding. During the 2004 monitoring period, lower Yuba River daily average water temperatures never reached or exceeded the 68°F water temperature index value. The 64°F water temperature index value was exceeded at the Highway 70 site (RM 1), on three occasions (4.8 percent) during the transfer period, and on 13 occasions (45.0 percent) during the post-transfer period. However, at the Daguerre Point Dam water temperature monitoring site, water temperatures never reached or exceeded the 64°F water temperature index value. Water temperature monitoring in the lower Yuba River at Highway 70 (RM 1) indicated that the 60°F index value was reached or exceeded on 29 occasions (67.4 percent) before the transfer, and all of the time during and after the transfers. At Daguerre Point Dam, the 60°F water temperature index value was not reached or exceeded during the pre-transfer period, but was reached or exceeded on two occasions (3.2 percent) during the transfer period and on 25 occasions (83.3 percent) during the post-transfer period (SWRI 2005).

Evaluation of Feather River water temperatures and Chinook salmon adult immigration and holding indicated that water temperatures in the Feather River (four miles downstream on the left bank), for example, exceeded each of the three established water temperature index values developed (60°F, 64°F, and 68°F). The 60°F index value was reached or exceeded 100 percent of the time during the monitoring period in the Feather River left bank, four miles downstream from the Yuba River confluence. The daily average water temperature at this location reached or exceeded the 64°F index value on 41 (95.3 percent), 63 (100 percent), and 24 (80 percent) occasions before, during, and after the water transfer. The 68°F index value was reached or exceeded on 25 (58.1 percent) occasions during the pre-transfer period and on 11 (17.5 percent) occasions during the transfer period, but was not exceeded during the post-transfer period (SWRI 2005).

Water Temperatures

Water temperatures measured at the Smartville site (at RM 24, approximately 2 miles downstream of Englebright Dam) during the 2004 water transfers study period are representative of the relatively stable, low water temperatures associated with reservoir releases occurring during this time of the year (May through October). Smartville daily mean water temperatures did not display large fluctuations between consecutive days, but did show an overall increasing temporal trend in daily average water temperature from 51.6°F on May 1 to 55.9°F on October 1, 2004.

Daily mean water temperatures during the 2004 study period for monitoring sites farther downstream retained an overall increasing temporal trend from May 1 through October 1, which dissipated as distance from the dam increased, reflecting the progressive warming and increasing diurnal variation in downstream Yuba River water temperatures. Average daily water temperatures progressively increased as the site location approached the Yuba-Feather river confluence, and the daily water temperature ranges became progressively larger. For example, at Parks Bar (RM 18) daily water temperature minimum and maximum differed, on average, by 4.5°F, while at Long Bar (RM 14), the daily water temperature minimum and maximum differed by 5.4°F. At Daguerre Point Dam (RM 11), the differences between the minimum and maximum daily water temperatures averaged 7.6°F, while at the Marysville (RM 6) and Simpson Lane (RM 3) water temperature monitoring locations, the average difference was approximately 9.4°F and 9.9°F, respectively.

From May 1 through October 1, 2004, Feather River water temperatures at monitoring locations upstream and downstream of the confluence with the Yuba River were consistently higher than those of the lower Yuba River. Downstream of the Yuba-Feather river confluence, daily average water temperatures were consistently lower on the left bank of the Feather River than on the right bank, suggesting that the cooling effect of lower Yuba River water temperatures predominantly affects the left bank of the Feather River. Moreover, based upon the regression analysis performed, the influence of lower Yuba River flows on Feather River water temperatures is reduced considerably within the first two miles of river occurring downstream of the confluence of the Yuba and Feather rivers.

4.4.1.2 New Bullards Bar Reservoir

New Bullards Bar Reservoir has steeply sloped sides created from the flooding of a deep canyon. New Bullards Bar Reservoir supports both coldwater and warmwater fisheries including rainbow trout, kokanee salmon, brown trout, largemouth bass, smallmouth bass, crappie, sunfish, and bullhead (DWR 2000a). Although warmwater fish species are known to occur in New Bullards Bar Reservoir (crappie, largemouth and smallmouth bass, and sunfish), limited recreational fisheries exist for these warmwater fish species. New Bullards Bar Reservoir supports an important salmonid fishery and is reported as having the best kokanee salmon fishing throughout the State of California (Jones and Pack 2002 as *cited in* DWR and Reclamation 2003).

4.4.1.3 Feather River

The lower Feather River begins at the Low Flow Channel, which extends eight miles from the Fish Barrier Dam (RM 67) to the Thermalito Afterbay Outlet (RM 59). The lower Feather River from the Fish Barrier Dam to Honcut Creek supports a variety of anadromous and resident fish species. The most important fish species in terms of sport fishing is the fall-run Chinook salmon, although striped bass and American shad also are common targets for anglers. Fall-run Chinook salmon may enter the river as early as August and begin spawning in September. Spawning typically continues through December, with October and November constituting the peak spawning months in the lower Feather River.

Several other native and exotic fish species are found in the Feather River including spring-run Chinook salmon, steelhead and Sacramento splittail. In the Feather River, the basic life history of spring-run Chinook salmon is similar to fall-run Chinook salmon. Spawning may occur a few weeks earlier for spring-run (as compared to fall-run), but there is no clear distinction between the two runs due to the disruption of spatial separation by Oroville Dam. Fish exhibiting the typical life history of the spring-run are found holding at the Thermalito Afterbay Outlet and the

Fish Barrier Dam as early as March. At present, the genetic distinctness of Feather River spring-run is undetermined.

Adult steelhead typically ascend the Feather River from September through January. The residence time of adult steelhead in the Feather River after spawning and adult steelhead post-spawning mortality is currently unknown. It appears that most of the natural steelhead spawning in the Feather River occurs in the Low Flow Channel, particularly in the upper reaches near Hatchery Ditch. It is unknown whether steelhead spawn below the Thermalito Afterbay outlet. However, based on the spawning habitat available, it is very likely that at least some steelhead spawn below the Thermalito Afterbay outlet. Soon after emerging from the gravel, a small percentage appears to emigrate. The remainder of the population rears in the river for at least six months to one year. Recent studies have confirmed that juvenile steelhead rearing (and probably adult steelhead spawning) is most concentrated in small secondary channels within the Low Flow Channel. The smaller substrate size and greater amount of cover (compared to the main river channel) likely make these side channels more suitable for steelhead spawning.

4.4.1.4 Lake Oroville

Like many other California foothill reservoirs, Lake Oroville is steep-sided, with large surface fluctuations and low surface area-to-volume ratio. It is a warm, monomictic reservoir that thermally stratifies in the spring, destratifies in the fall, and remains destratified throughout the winter. Due to the stratification, Lake Oroville has been said to contain a “two-story” fishery, supporting both coldwater and warmwater fisheries that are thermally segregated for most of the year. The coldwater fish use the deeper, cooler, well-oxygenated hypolmnion, whereas the warmwater fish are found in the warmer, shallower, epilimnetic and littoral zones. Once Lake Oroville destratifies in the fall, the two fishery components mix in their habitat utilization.

Lake Oroville’s coldwater fishery primarily is comprised of coho salmon and brown trout, although rainbow trout and lake trout are periodically caught. The coldwater fisheries for coho salmon and brown trout are sustained by hatchery stocking because natural recruitment to the Lake Oroville coldwater fishery is very low. A “put-and-grow” hatchery program is currently in use, where salmonids are raised at CDFG hatcheries and stocked in the reservoir as juveniles, with the intent that these fish will grow in the reservoir before being caught by anglers (DWR 2001a).

The Lake Oroville warmwater fishery is a regionally important self-reproduction fishery. The black bass fishery is the most significant, both in terms of angler effort and economic influence on the area. Spotted bass are the most abundant bass species in Lake Oroville, followed by largemouth, redeye, and smallmouth bass, respectively. Catfish are the next most popular warmwater fish at Lake Oroville, with both channel and white catfish present in the lake. White and black crappie also are found in Lake Oroville, though populations fluctuate widely from year to year. Bluegill and green sunfish are the two primary sunfish species in Lake Oroville. Although common carp are considered by many to be a nuisance species, they are abundant in Lake Oroville (DWR 2001a). The primary forage fish in Lake Oroville are wakasagi and threadfin shad. Threadfin shad intentionally were introduced in 1967 to provide forage for gamefish, whereas the wakasagi migrated down from an upstream reservoir in the mid-1970s.

4.4.1.5 Sacramento River

The upper Sacramento River is often defined as the portion of the river from Princeton (RM 163), the approximate downstream extent of salmonid spawning in the Sacramento River to Keswick Dam (the upstream extent of anadromous fish migration and spawning). The lower Sacramento River is generally defined as that 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. The Sacramento River serves as an important migration corridor for anadromous fishes moving between the Pacific Ocean and/or Delta and upper river/tributary spawning and rearing habitats.

In excess of 30 fish species are known to use the Sacramento River. Of these, a number of both native and introduced species are anadromous. Anadromous species include Chinook salmon, steelhead, green and white sturgeon, striped bass, and American shad. The upper Sacramento River is of primary importance to native anadromous species, and is presently utilized for spawning and early-life-stage rearing, to some degree, by all four runs of Chinook salmon (i.e., fall, late-fall, winter, and spring runs) and steelhead. Consequently, various life stages of the four races of Chinook salmon, and steelhead, can be found in the upper Sacramento River throughout the year. Other Sacramento River fishes are considered resident species, which complete their lifecycle entirely within freshwater, often in a localized area. Resident species include rainbow and brown trout, largemouth and smallmouth bass, channel catfish, sculpin, Sacramento pikeminnow, Sacramento sucker, hardhead, and common carp (Reclamation 1991).

Many of the fish species utilizing the upper Sacramento River also use the lower river to some degree, even if only as a migratory pathway to and from upstream spawning and rearing grounds. For example, adult Chinook salmon and steelhead primarily use the lower Sacramento River as an immigration route to upstream spawning habitats, and as an emigration route to the Delta. The lower river also is used by other fish species (e.g., Sacramento splittail and striped bass) that make little use of the upper river (i.e., upstream of RM 163). Overall, fish species composition in the lower portion of the Sacramento River is similar to that of the upper Sacramento River and includes resident and anadromous cold- and warmwater species. Many fish species that spawn in the Sacramento River and its tributaries depend on river flows to carry their larval and juvenile life stages to downstream nursery habitats. Native and introduced warmwater fish species primarily use the lower river for spawning and rearing, with juvenile anadromous fish species also using the lower river, to some degree, for rearing.

4.4.1.6 Sacramento-San Joaquin Delta

The Delta provides spawning and nursery habitat for more than 40 resident and anadromous fish species, including delta smelt, Sacramento splittail, American shad, and striped bass. The Delta also is a migratory corridor and seasonal rearing habitat for the various runs of Chinook salmon and steelhead.

Many factors have contributed to the decline of Delta fish species, including loss of habitat, contaminant input (water quality degradation), entrainment in diversions, and introduction of non-native fish species. The Delta is a network of channels through which water, nutrients, and aquatic food resources are moved and mixed by tidal action. Pumps and siphons divert water for

Delta irrigation and municipal and industrial use or into CVP and SWP canals. River inflow, Delta Cross Channel operations, and diversions (including agricultural and municipal diversion and export pumping) affect Delta species through changes in habitat conditions (e.g., salinity intrusion) and mortality attributable to entrainment in diversions.

4.4.1.7 San Luis Reservoir

San Luis Reservoir provides habitat for both coldwater and warmwater fisheries. The game fish found in San Luis Reservoir include largemouth bass, crappie, sunfish, striped bass, and bullhead.

4.4.2 IMPACT ASSESSMENT METHODOLOGY

The Environmental Analysis considers the potential for unreasonable impacts upon fisheries resources in the water bodies potentially influenced by the proposed 2005 transfer of water from YCWA to DWR. This evaluation therefore includes assessment of potential effects upon river systems and reservoirs including Yuba River, New Bullards Bar Reservoir, Feather River, Lake Oroville, Sacramento River, Delta, and San Luis Reservoir. The impact assessment methodology utilized to conduct this assessment is described below.

4.4.2.1 Reservoir Impact Assessment Methodology

The analysis of potential effects on reservoir fisheries associated with the proposed water transfer was based upon consideration of anticipated seasonal changes in reservoir storage under the without-transfer condition and the proposed water transfer condition. The values for New Bullards Bar Reservoir storage were based upon information provided in the Hydrologic Analysis (Appendix A). The evaluation of reservoir storage for Lake Oroville and San Luis Reservoir were performed qualitatively based on anticipated potential changes in operations associated with the proposed water transfer, to the extent that this information was available, and primarily from assessments conducted for recent water transfer years (EDAW 2002; 2004).

Potential changes in reservoir water surface elevations were considered for the analysis of potential increases in the frequency of warmwater fish nest-dewatering events and decreases in coldwater pool volume, that could occur under proposed water transfer conditions, relative to without-transfer conditions.

Reservoir Coldwater Fisheries

Coldwater fish in the reservoirs reside primarily within the reservoir's metalimnion (middle of the reservoir) and hypolimnion (near the bottom) where water temperatures remain suitable during the period when reservoirs are thermally stratified (generally, April through November). Reduced reservoir storage during this period could reduce the reservoir's coldwater pool volume, thereby reducing the quantity of habitat available to coldwater fish species during these months. Reservoir coldwater pool size generally decreases, although not always in direct proportion because of the influence of river basin morphometry. The analysis of potential effects on reservoir coldwater fisheries associated with the proposed water transfer was based on the following criteria:

- Decrease in reservoir storage, which also would reduce the coldwater pool, relative to the without-transfer condition, of sufficient magnitude or duration to adversely affect long-term population levels of coldwater fish.

Reservoir Warmwater Fisheries

Warmwater fish species in reservoirs use the warm upper layer of the reservoir and nearshore littoral habitat throughout most of the year. Seasonal changes in reservoir storage, as it affects reservoir water surface elevation (feet msl) can directly affect the reservoir's warmwater fish resources. Decreases in reservoir water surface elevation during the primary spawning period for nest building warmwater fish (March into June) may result in reduced initial year-class strength through warmwater fish nest "dewatering."

To assess potential elevation-related effects to warmwater fish in the evaluated reservoirs, the magnitude of change (feet msl) in reservoir water surface elevation occurring each month of the spawning period (i.e., March through June) for nest-building fish under the proposed water transfer relative to the without-transfer condition was considered, when available. Review of available literature suggests that, on average, self-sustaining black bass populations in North America experience a nest success (i.e., the nest produces swim-up fry) rate of 60 percent (Latta 1956; Kramer and Smith 1962; Turner and MacCrimmon 1970; Hurley 1975; Neves 1975; Goff 1986; Raffetto *et al*. 1990; Ridgway and Shuter 1994; Lukas and Orth 1995; Philipp *et al*. 1997; Friesen 1998; Knotek and Orth 1998; Hunt and Annett 2002; Steinhart 2004).

A study by CDFG, which examined the relationship between reservoir water surface elevation fluctuation rates and nesting success for black bass, suggests that a reduction rate of approximately six feet per month or greater would result in 60 percent nest success for largemouth bass and smallmouth bass (Lee 1999). Therefore, a decrease in reservoir water surface elevation of six feet or more per month was selected as the threshold beyond which spawning success of nest-building warmwater fish could potentially result in population effects. The analysis of potential effects on warmwater fisheries associated with the proposed water transfer was based on the following criteria:

- Decrease in reservoir water surface elevation of greater than or equal to six feet per month, relative to the without-transfer conditions, of sufficient frequency to substantially affect population levels of warmwater fish for a given month in the extended spawning period, especially during the primary spawning period.

4.4.2.2 Rivers Impact Assessment Methodology

Instream flow and water temperature are important parameters related to the production and condition of aquatic resources in riverine environments. Instream flow, and the magnitude and duration of flow fluctuation events, may affect fish populations, particularly salmonid populations, by determining the amount of available habitat or altering the timing of life history events (e.g., spawning). Rapid changes in flow have the potential to affect the survival of eggs and alevins by exposing redds, and rapidly receding flow conditions may strand juveniles in pools and side channels or on beach substrates where dessication, rapidly increasing water temperature, and predation may affect overall survival. In addition, water temperatures influence metabolic, physiologic, and behavioral patterns, as well as fecundity and overall spawning success of fish populations (SWRI 2003).

The evaluation of potential effects of the proposed water transfer on Yuba River fisheries was focused upon specific issues or concerns identified by fisheries resources agencies. The specific methodology for the assessment of potential effects on juvenile salmonid movement, potential attraction of non-native Chinook salmon into the Yuba River, and water temperature topics are described in detail in the *Evaluation of the 2004 Yuba River Water Transfers* (SWRI 2005). Information regarding assessment of potential effects upon New Bullards Bar Reservoir cold water reserves is from past water transfer studies (EDAW 2004). The discussion of potential influences of the proposed water transfer upon beaching, stranding and isolation of anadromous salmonids is based upon information presented in past water transfer studies (EDAW 2002; 2004) and with information provided by CDFG *via* memorandum regarding the 2004 proposed water transfer (CDFG 2004), and based upon anticipated operations for the proposed 2005 water transfer.

Additionally, to assess potential impacts from the proposed water transfer on fisheries resources and aquatic habitat in the Yuba and Feather rivers, potential flow and water temperature impacts were evaluated based upon known environmental conditions and operational regimes that are in place for these systems. The analysis of potential effects on Yuba and Feather river fisheries associated with the proposed water transfer was based on the following criteria:

- Decrease in river flows, relative to the without-transfer condition, of sufficient magnitude or duration, to adversely affect anadromous salmonid life stages.
- Increase in water temperature, relative to the without-transfer condition, of sufficient magnitude or duration, to adversely affect anadromous salmonid life stages.

Because an evaluation of how the transfer amount would be released into the Sacramento River is not straightforward, a more generalized assessment approach was taken to evaluate potential impacts of the proposed water transfer on the Sacramento River because of: (1) the relative volume of water being transferred from the Yuba River and its contribution to the total volume of Sacramento River flow; and (2) the increased operational flexibility of the CVP/SWP system, which allows for conveyance of this transfer amount to occur over a multitude of potential release patterns from various source reservoirs (i.e., Shasta or Oroville).

Although the specific release pattern is unknown at this time and will depend on CVP/SWP operational conditions as they develop over the summer, the release, when it occurs, will be subject to certain operational constraints (e.g., ramping criteria) that are within normal operational parameters. To evaluate the potential range of impacts to fisheries resources in the Sacramento River that could occur as a result of the proposed water transfer, potential transfer release amounts were compared to mean monthly flow values for the Sacramento River at Freeport (Table 1).

4.4.3 IMPACT ASSESSMENT

4.4.3.1 Yuba River

The discussion of potential fisheries resources impacts for the lower Yuba River focuses on issues raised related to recent water transfers. Specifically, the topics addressed in this evaluation include:

- Potential Water Transfer-related Effects on Juvenile Salmonid Movement in the Yuba River
  - Inducement of Juvenile Salmonid Downstream Movement
  - Downstream Extension of Cold Water Habitat
- Potential Water Transfer-related Effects on Attraction of Non-native Adult Chinook Salmon in the Yuba River
- Cold Water Reserves for Fall Releases from New Bullards Bar Reservoir
- Beaching, Stranding and Isolation of Anadromous Salmonids in the Lower Yuba River

Potential Water Transfer-related Effects on Juvenile Salmonid Movement in the Yuba River

Juvenile Salmonid Downstream Movement

Water transfers characterized by substantial increases in flows at the onset of the transfer, particularly when initiated in summer months when flows are at the instream minimum levels, have the potential to result in adverse impacts to aquatic resources, especially if the instream flows diverge substantially from the natural hydrograph (e.g., extremely high summer flows during critical water years). CDFG indicates that a significant increase in the magnitude of flow is a primary factor that induces steelhead and Chinook salmon to outmigrate (CDFG 2004).

The proposed 2005 water transfer would increase the rate of release from New Bullards Bar Reservoir from as early as mid-June/early July through September, with the additional flow related to the BVID water transfer to SCVWD in early October. Flows down the lower Yuba River under both the maximum and minimum water transfer scenarios would result in flows above the required minimum instream flows, relative to the without-transfer condition, for the duration of the transfers. As described in the Hydrologic Analysis (Appendix A), initiation of the proposed transfer under the maximum water transfer scenario, potentially in both Below Normal and Dry water year conditions, has the potential to result in a June reduction in flow, from which YCWA would have to ramp-up from the applicable minimum instream flow to a higher flow level required for the transfer. This condition also potentially exists under the minimum water transfer scenario under Dry water year conditions, although the ramp-up required would be of reduced magnitude (Appendix A).

Based on discussions held between YCWA and resource agencies (CDFG, NMFS, and USFWS) in February 2005, if one of the transfer scenarios described above would occur, YCWA would ramp-up at a target rate of approximately 100 cfs per day until the maximum transfer flow was attained, and not more than 150 cfs per day taking into account operational limitations of the Yuba Project. This ramp-up rate scenario is similar to the terms of the 2004 water transfer, as agreed upon between YCWA and the resource agencies. Additionally, the resource agencies would consider implementation of a higher ramp-up rate (e.g., up to 200 cfs per day) if the maximum water transfer scenario occurs in a Below Normal or wetter year. The projected fluctuations in river flows would be of reduced magnitude and duration if the water transfers are initiated in June rather than July. In 2004, the total ramp-up for the water transfer was 122 cfs over the course of two days; a 67 cfs increase in flows from June 30 to July 1, 2004 and a 55 cfs increase in flows from July 1 to July 2, 2004 (at the Smartville gage). The 2004 water transfer monitoring and evaluation studies did not observe or report any consistent trend between juvenile steelhead counts (at the rotary screw traps) and Yuba River streamflow prior to, during, or immediately following initiation of the 2004 water transfer. Based on this information, and because the proposed ramp-up rate for 2005 would be implemented in a similar manner as in 2004, the proposed 2005 water transfer would not be expected to result in the inducement of juvenile salmonid downstream movement from above Daguerre Point Dam to below Daguerre Point Dam in the lower Yuba River, or from the Yuba River to the Feather River.

Downstream Extension of Cold Water Habitat

Resource agency representatives also have expressed concern regarding the creation or extension of coldwater habitat in the lower Yuba River associated with water transfer operations. As discussed previously (*Summary of Recent Water Transfer Fisheries Monitoring Studies and Findings*), it appears that water transfers may be associated with the extension of cooler water temperatures farther downstream in the lower reaches of the Yuba River (i.e., below Daguerre Point Dam). Generally, such extension of coldwater habitat further downstream can be beneficial to fisheries resources by providing a larger area of suitable habitat. However, once the transfer terminates, if the extended cool water habitat is not maintained, areas of suitable cool water habitat may shift upstream and fish in the lower downstream reaches that do not also shift upstream may be subjected to stressful water temperatures.

In the Yuba River, habitat in the lower river below Daguerre Point Dam and, in particular, below Hallwood Boulevard generally is considered poor over-summering habitat for juvenile salmonids, relative to reaches upstream of Daguerre Point Dam (see *Yuba River Environmental Setting*). CDFG has identified concerns regarding the decreased survival of fish remaining in the lower reaches of the river following the end of the water transfer due to elevated water temperatures and increased predation (CDFG 2004).

Unreasonable impacts to juvenile salmonids are not expected to occur under the proposed 2005 water transfer conditions, relative to the without-transfer conditions, for the following reasons.

- Analyses of past water transfer data, the finding that the 2004 water transfer did not induce the non-volitional downstream movement of juvenile salmonids, and the similarity between the ramp-up rates implemented in 2004 and proposed for 2005.

- Daily average water temperatures in the lower reaches of the lower Yuba River were consistently within the range considered suitable for juvenile steelhead before, during and after the water transfer period in 2004. Although water temperature is known to affect juvenile salmonid distribution, growth, movement and survival, based on the data collected it cannot be concluded that post-transfer water temperature conditions adversely affected juvenile steelhead in 2004. However, it is recognized that water temperature conditions are variable and are influenced by climatic conditions, and should continue to be monitored before, during and after the transfer period in 2005.

Potential Water Transfer-related Effects on Attraction of Non-native Adult Chinook Salmon in the Yuba River

Chinook salmon straying is fairly common in Central Valley streams throughout the Chinook salmon distribution. However, introducing non-native Chinook salmon (especially of hatchery origin) at high rates may be detrimental to the overall well-being of self-sustaining natural Chinook salmon populations, such as those in the Yuba River. Although some straying of non-indigenous Chinook salmon into the Yuba River occurs every year, resource agencies have expressed concern regarding the potential for the Yuba River water transfers *via* decreased water temperatures and increased proportions of flow, relative to the Feather River, to encourage non-natal Feather River hatchery Chinook salmon to stray into the Yuba River.

As described previously in the discussions under *Summary of Recent Water Transfer Fisheries Monitoring Studies and Findings*, some straying of anadromous salmonids into the Yuba River is a natural phenomenon, and also occurs every year under various prevailing water conditions. It should be recognized that increases in Yuba River flows, whether from water transfers, increased minimum instream flow requirements ordered by the SWRCB, or flood flow releases potentially may attract salmonids into the Yuba River. Additionally, straying of non-Yuba River origin adult Chinook salmon can be influenced by Feather River flows, hatchery release location and timing, and other factors.

Overall, based on the findings of monitoring studies conducted for recent YCWA water transfers, the flow changes associated with the proposed 2005 water transfer are not expected to result in unreasonable impacts related to straying of non-indigenous adult salmonids in the Yuba River. Moreover, the increased instream with-transfer September flows could slightly reduce water temperatures and could slightly improve migratory conditions for spring-run Chinook salmon and fall-run Chinook salmon, particularly below Daguerre Point Dam, relative to the without-transfer condition. With-transfer conditions also could improve water temperature and habitat conditions for pre-spawning adult salmon and potentially reduce egg mortality.

Coldwater Reserves for Fall Releases from New Bullards Bar Reservoir

During previous water transfers involving YCWA, concern has been expressed about the loss of coldwater reserves for fall releases from New Bullards Bar Reservoir. Monitoring conducted for SWRCB following YCWA's 1997 water transfer to Reclamation indicates that a reduction of 75,000 acre-feet did not significantly reduce available coldwater storage. In addition, water temperature profiles in the reservoir indicate that the thermocline (the depth zone of a lake or reservoir in which there is a rapid decrease in temperature with water depth) extends to depths of 50 to 60 feet in late summer and early fall. Below a depth of about 120 feet, water temperatures are relatively low and stable (40°F to 45°F) (EDAW 2004; Appendix A, Figure 9). The low-level penstock outlet draws water at reservoir elevations from 1,623 to 1,675 feet, well below the elevation range where the thermocline likely would be in 2005. It is expected that this current transfer would not cause any unreasonable impacts on the coldwater pool in 2005 or 2006. Benefits would result from the release of the water, and YCWA would maintain sufficient water in New Bullards Bar Reservoir to meet cold water storage needs, contractor demands, and minimum instream flow requirements in 2006.

Beaching, Stranding and Isolation of Anadromous Salmonids in the Lower Yuba River

Substantial decreases in instream flows at the conclusion or "ramp-down" phase of the water transfer are of concern because of the potential that fish stranding could result when flows in the river decrease. As juvenile salmonids grow, they move from the shallower backwater/side channel habitats to faster water associated with the main channel. However, stranding or isolation of juvenile salmonids can occur in side pools or channels with an increasing gradient towards the main channel if these areas become isolated from the main river channel due to flow reductions. It is recognized that there are side channels along the lower Yuba River that could become isolated from the main river channel if flow fluctuations at the end of the transfer period are not managed carefully. Due to these concerns, during the proposed 2005 water transfer, YCWA would implement a maximum ramp-down rate of 200 cfs per day, in four increments of about 50 cfs each, as was done for the 2004 water transfer (EDAW 2004). These proposed rates are more restrictive than the ramp-down rates in the current SWRCB RD-1644. The proposed September and October "with-transfer" flows of approximately 500 cfs below Daguerre Point Dam would further reduce any potential risk of Chinook salmon redd dewatering or stranding when the transfer ends. Additionally, YCWA and resource management agencies have developed and agreed upon the experimental design and study plan to evaluate potential for redd dewatering and fry stranding in the lower Yuba River, as required by RD-1644 (YCWA 2003c: Lower Yuba River Redd Dewatering and Fry Stranding Monitoring and Evaluation Plan, prepared by Jones and Stokes; November 2003).

Summary of Water Transfer-Related Impacts on Central Valley Spring- and Fall-Run Chinook Salmon and Central Valley Steelhead in the Yuba River

Potential flow and water temperature-related effects on anadromous salmonids in the lower Yuba River resulting from the proposed water transfer are not expected to result in unreasonable impacts upon these fisheries resources. Lower Yuba River instream flows are expected to increase and water temperatures are expected to decrease during the proposed 2005 water transfer, relative to the without-transfer condition. However, changes in instream flows and water temperatures are not expected to result in unreasonable impacts on the various anadromous salmonid life stages occurring coincident with the water transfer period (steelhead juvenile rearing and downstream movement, and adult Chinook salmon immigration) in the Yuba River.

YCWA and the resource agencies are continuing to collaboratively work toward improving conditions in the lower Yuba River. As part of these ongoing efforts, water transfer strategies have been carefully designed, implemented and monitored to avoid adverse impacts on juvenile and adult anadromous salmonids. Over the past several years, YCWA has worked collaboratively with fisheries resources agencies to reduce the potential for adverse effects upon fisheries resources in the lower Yuba River potentially associated with water transfer operations. Based upon the on-going, adaptive management practices implemented by YCWA in conjunction with fisheries resources agencies, it would be expected that no unreasonable impacts to fisheries resources would occur under the proposed 2005 water transfer conditions, relative to the without-transfer conditions. Based on preliminary data analyses and a continued commitment to resource agency involvement and appropriate monitoring and related management actions, the proposed 2005 water transfer is not expected to result in unreasonable impacts to fishery resources within the Yuba River.

Moreover, YCWA is committed to working with the resource management agencies to fund and implement appropriate fisheries-related monitoring activities on the lower Yuba River. Anticipated monitoring activities which encompass the 2005 water transfer period will include: (1) YCWA's continued monitoring and reporting of streamflow and water temperature at the Smartville and Marysville gages, and water temperature at Daguerre Point Dam; (2) CDFG's and USFWS' continued coordination and year-round operation of the VAKI RiverWatcher system at the Daguerre Point Dam fish ladders; and (3) YCWA's continued conduct of Chinook salmon carcass surveys in fall 2005. Any additional monitoring, if determined necessary, will be developed in on-going coordination and consultation efforts between YCWA and CDFG, NMFS and USFWS representatives.

4.4.3.2 New Bullards Bar Reservoir

New Bullards Bar Reservoir Coldwater Fisheries

During the period when New Bullards Bar Reservoir is thermally stratified, coldwater fish within the reservoir reside primarily within the reservoirs metalimnion and hypolimnion where water temperatures remain suitable. Reduced reservoir storage (acre-feet) during this period potentially could reduce the reservoir's coldwater pool volume, thereby reducing the quantity of habitat available to coldwater fish species. Reservoir coldwater pool size generally decreases as reservoir storage decreases, although not always in direct proportion because of the influence of reservoir basin morphometry.

Hydrologic conditions under the proposed water transfer would result in a reduction in storage of up to 100,000 acre-feet at New Bullards Bar Reservoir by the end of the transfer period, relative to the "without-transfer" condition. This reduction under the maximum water transfer corresponds to a change in water surface elevation of up to approximately 28 feet. Under the minimum water transfer scenario, water surface elevation in New Bullards Bar Reservoir would be drawn down approximately 15 feet by the end of the transfer period. Drawdown associated with the proposed water transfer primarily would occur between July 1 and August 31, 2005. Water levels during the primary reservoir fish spawning period would mostly be unaffected by the transfer, except potentially during the period of June 1 to June 30, if the transfer begins in June.

Anticipated reductions in reservoir storage would not be expected to adversely affect the New Bullard Bar Reservoir's coldwater fisheries because New Bullards Bar Reservoir is a deep, steep-sloped reservoir with ample coldwater pool reserves. Throughout the period of operations of New Bullards Bar Reservoir (1969 through present), which encompasses the most extreme critically dry year on record, the coldwater pool in New Bullards Bar Reservoir has not been depleted. In fact, since 1993, coldwater pool availability in New Bullards Bar Reservoir has been sufficient to accommodate year-round utilization of the lower river outlets at the direction provided by CDFG in order to provide the coldest water possible to the lower Yuba River. Therefore, potential anticipated reductions in cold water storage would not be expected to adversely affect New Bullard Bar Reservoir's coldwater fisheries because: (1) coldwater habitat would remain available in the reservoir during all months of the proposed transfer period; (2) physical habitat availability is not believed to be among the primary factors limiting coldwater reservoir fish populations; and (3) anticipated seasonal reductions in storage would not be expected to adversely affect the primary prey species utilized by coldwater fish. Therefore, changes in end-of-month storage at New Bullards Bar Reservoir under the with-transfer condition would not result in unreasonable impacts to coldwater fisheries resources, relative to the without-transfer condition.

New Bullards Bar Reservoir Warmwater Fisheries

The spawning period for warmwater fish is believed to generally extend from March through June. However, the majority of warmwater fish spawning occurs during the months of April and May. Hydrologic conditions under the proposed 2005 water transfer would result in reductions of up to 28 feet msl under the maximum water transfer scenario, or up to 15 feet under the minimum water transfer scenario by the end of the transfer period. However, drawdown of New Bullards Bar Reservoir storage, and related decreases in water surface elevations, would not occur until initiation of the water transfer, anticipated to occur as early as mid-June but more likely to begin on July 1, 1005. This drawdown is primarily outside of the March through June period (when warmwater fish spawning may be expected). Anticipated water surface elevation changes associated with the proposed 2005 water transfer would be within normal operating ranges (personal communication, S. Grinnell 2005; Appendix A).

Reductions in end-of-month water surface elevation in New Bullards Bar Reservoir under the proposed water transfer would not be anticipated to result in substantial reductions in warmwater fish spawning success, because reductions in water surface elevation of greater than six feet would occur outside of April and May, the primary spawning period. Additionally, if the water transfer were to be initiated by June 15, reductions in water surface elevations, under both the minimum and maximum water transfer scenarios would be less than 6 feet. Under the minimum water transfer scenario, the anticipated reduction in water surface elevation would be up to 15 feet by mid-October. Under the maximum water transfer scenario, the anticipated reduction in water surface elevation would be up to 28 feet by mid-October. While it is acknowledged that some species' (i.e., sunfish) spawning periods can extend through June, the criteria used to evaluate nest-dewatering events were developed for bass species and do not necessarily apply to sunfish and catfish. Although there could be a reduction in reservoir water surface elevation in June, the majority of warmwater fish spawning, including sunfish if present, occurs in April and May. Therefore, the reductions that could occur would not be of sufficient magnitude during the primary spawning period to adversely affect the spawning success of these species.

Potential reductions in water surface elevation under the proposed 2005 water transfer would not be anticipated to result in unreasonable impacts upon warmwater fisheries that may be present in New Bullards Bar Reservoir.

4.4.3.3 Feather River

Overall, flows in the Feather River would not be expected to differ substantially under the proposed water transfer condition relative to the without-transfer condition. Slight increases in flows could occur, although, these increases would not be of sufficient duration or magnitude to result in adverse or unreasonable effects to Feather River fisheries resources. Neither physical habitat availability for fish residing in the Feather River nor immigration of adult or emigration of juvenile anadromous fish would be substantially affected by the anticipated flow increases that could occur under either the maximum or minimum water transfer scenarios developed for the proposed water transfer, relative to the without-transfer condition. The increased contribution of flow from the proposed water transfer to Feather River flows would not adversely affect the fisheries resources of the Feather River. Additionally, because flows in the Feather River below the Yuba River would be expected to be approximately four to five times higher than Yuba River flows, the effect of the proposed water transfer on Feather River water temperatures would not be expected to be significant or unreasonable (Appendix A).

4.4.3.4 Lake Oroville

Lake Oroville water levels would be affected by the proposed water transfer (either scenario) only if DWR had to release additional flows to meet water quality standards in the Delta as a result of YCWA holding back water to refill New Bullards Bar Reservoir after the completion of the proposed 2005 water transfer. The potential drawdown of Lake Oroville would be minimal given the much larger size of Lake Oroville, and most likely would occur in winter or spring. Spawning fish potentially could be affected, but the level of drawdown would be small and within normal operating conditions for Lake Oroville. Consequently, potential impacts to Lake Oroville reservoir fisheries are not considered unreasonable.

4.4.3.5 Sacramento River

Although the specific release pattern is uncertain at this time and will depend on CVP/SWP operational conditions as they develop over the summer, the release, when it occurs, will be subject to certain operational constraints (e.g., ramping criteria) that are within normal operational parameters.

Neither physical habitat availability for fish residing in the Sacramento River nor immigration of adult or emigration of juvenile anadromous fish would be substantially affected by the anticipated flow increases that could occur under the proposed water transfer, relative to the without-transfer condition. The increased contribution of flow from the proposed water transfer to Sacramento River flows would not adversely affect the fisheries resources of the Sacramento River. Potentially slightly higher flows in the Sacramento River would be marginally beneficial for winter-run Chinook salmon that migrate up the Sacramento River in June and July to spawn upstream during June through August.

The proposed water transfer would not compromise compliance with environmental regulations that specify minimum flow requirements for winter-run and spring-run Chinook salmon and Central Valley steelhead under either transfer scenario, relative to the without-transfer condition.

Required releases from New Bullards Bar Reservoir, Englebright Reservoir, and Lake Oroville for the protection of fisheries resources would continue to be made by YCWA and DWR.

4.4.3.6 Sacramento-San Joaquin Delta

The current regulatory requirements for managing Delta exports include:

- 1995 Delta Water Quality Control Plan (SWRCB)
- 2004 Winter-run Chinook Salmon Biological Opinion (NMFS)
- 2004 Delta Smelt Biological Opinion (USFWS)

Compliance with the environmental agreements and requirements stipulated in these regulations would preclude the occurrence of any unreasonable impacts on fish as a result of the pumping of any portion of the transfer water from the Delta. Consequently, the transfer water would become part of the overall SWP or CVP water supply with attendant environmental limitations for exporting water from the Delta. The impacts on the Delta from CVP/SWP making full use (within prescribed constraints) of its pumping capacities and any necessary mitigation have been documented (Reclamation 1992). Although Delta diversions generally can result in fishery impacts, it is the expectation that this water transfer may have a slight overall benefit to Delta fisheries through its actions that exceed the regulatory baseline established by the above environmental agreements. In addition, this water transfer would move water through the Delta at a time (summer) when the presence of sensitive life history stages for key species is minimized.

Water transfers such as the proposed YCWA transfer to DWR have been identified as an effective means of minimizing overall environmental effects and increasing CVP/SWP operational flexibility (SWRCB 1995 *as cited in* EDAW 2004). Consequently, potential impacts on Delta fisheries resources resulting from the proposed water transfer, under either scenario, would not be considered unreasonable given the on-going compliance with existing environmental requirements, the presence of EWA assets that could be used to offset any potential impacts, and the ability to enhance EWA assets through the transfer to DWR. The portion of the proposed transfer used as part of the EWA is expected to provide benefits to Delta fisheries by increasing operational flexibility. The proposed transfer amounts are within the levels evaluated in the EWA Final EIS/EIR (DWR and Reclamation 2004). Further, it is noted that the USFWS concurred in its Programmatic Biological Opinion on the EWA Program that the EWA was not likely to adversely affect delta smelt or its critical habitat (USFWS 2004). Similarly, NMFS found that the EWA was not likely to adversely affect Sacramento River winter-run Chinook salmon and its critical habitat, Central Valley spring-run Chinook salmon, and Central Valley steelhead (NMFS 2004).

4.4.3.7 San Luis Reservoir

DWR may store a portion of the proposed transfer water in San Luis Reservoir. To the extent that some of the transfer water (potentially up to 125,000 acre-feet by the end of the transfer period) is stored in San Luis Reservoir, the proposed transfer may have a potentially beneficial effect upon San Luis Reservoir fisheries resources. The storage volume associated with the proposed transfer potentially would provide increased habitat for reservoir species, relative to the without-transfer condition. Water stored in San Luis Reservoir likely would be held only for a short period prior to delivery to water contractors. Generally, it is expected that operations of San Luis Reservoir would remain within normal operational parameters, and the proposed water transfer would not result in unreasonable impacts on San Luis Reservoir fisheries.

4.5 TERRESTRIAL RESOURCES (WILDLIFE AND VEGETATION)

CDFG's Wildlife Habitat Relationship Program identifies 249 species of wildlife that use the valley and foothill habitats of the Sacramento Valley. These include 151 species of birds, 65 species of mammals, and 33 species of reptiles and amphibians. Riparian zones in the basin, the only terrestrial habitat that could potentially be affected by the transfer, provide migratory corridors, food and cover for wildlife species typical of riverine and upland areas. Numerous special-status and sensitive wildlife and plants species are found in the Sacramento River Basin including wildlife species that prefer riparian habitats such as Swainson's hawk, western yellow-billed cuckoo, willow flycatcher, western pond turtle, valley elderberry longhorn beetle, and bald eagle.

4.5.1 ENVIRONMENTAL SETTING

Yuba River

The Yuba River sub-basin is located on the eastern edges of the Sacramento Valley. It is bounded by the Feather River to the west, the Bear River to the south, Honcut Creek to the north and the Sierra foothills to the east. The primary land use is agriculture, with rice, pasture, and fruit and nut trees accounting for most of the crops. Rice fields are flooded in fall for rice stubble decomposition and the creation of wintertime waterfowl habitat. Agricultural drains and canals support wetland vegetation in some areas and provide habitat for wetland-associated species. In addition to agricultural land, the valley floor supports non-native grassland. Approximately two-thirds of the Yuba sub-basin is in the Sierra Nevada foothills. Habitats in this portion of the sub-basin include blue oak woodland, and valley oak woodland. Wildlife species are those typically associated with the habitats described above.

Foothill Yellow-Legged Frog

One occurrence (1997) of foothill yellow-legged frog in the Yuba River area is recorded in CDFG's Natural Diversity Database. This record is from Grizzly Gulch, which runs into Oregon Creek about 2 miles from upper New Bullards Bar Reservoir and is four to five miles from the location where transfer flows would be released to the Yuba River. There are no records of foothill yellow-legged frog occurrences along the lower Yuba River below Englebright Reservoir. Historically, foothill yellow legged frogs were found in the Coast Ranges from the Santiam River drainage in Oregon (Mehama and Marion Counties) to the San Gabriel River Drainage in California (Los Angeles County), and along the west slopes of the Sierra Nevada/Cascade Crest in most of central and northern California. The elevation range of the foothill yellow-legged frog extends from near sea level to about 6,000 feet in the Sierra Nevada. Foothill yellow legged frogs have disappeared from about 45 percent of their historic range in California and 66 percent of their historic range in the Sierra Nevada Mountains. Based on the results of recent surveys conducted on the Pit, North Fork Feather, North Fork Mokelumne, and

Middle Fork Stanislaus rivers, breeding populations of foothill yellow-legged frogs documented on these regulated rivers have all been below 3,000 feet in elevation, with the majority of the frogs occurring at elevations at or below 2,600 feet. *[Ibis Environmental, Inc. 2004. Results of 203 Surveys for Foothill Yellow-Legged Frog (Rana boylii) in the Mokelumne River Project Area. San Rafael, CA. prepared for Pacific Gas and Electric Company, as referenced in CDFG correspondence.]*

New Bullards Bar Reservoir

New Bullards Bar Reservoir supports a pair of nesting southern bald eagles, a species listed as endangered under the California ESA and listed as threatened under the federal ESA. Bald eagle production may be adversely affected by extreme drawdown of reservoirs during the period when eagle chicks are in the nest (DWR 1988).

Feather River

Although levees restrict the extent of riparian and wetland vegetation along the Feather River, this system still supports a diversity of riparian and wetland vegetation and wildlife communities. Willow scrub riparian habitat occupies frequently flooded areas closest to the river. Cottonwoods are more prominent in less frequently flooded areas, but still require and tolerate regular inundation. Valley oaks occupy the least flooded portion of the river. Backwater areas support freshwater emergent wetlands, which contribute to increasing the overall habitat diversity of the river. Wildlife consists of species typically found in riparian habitats of the Central Valley. In addition, the Feather River provides riverine habitat.

Lake Oroville

Habitats adjacent to Lake Oroville are predominantly oak woodland with some chaparral. The oak woodland habitat includes live oak, blue oak, and foothill pine, with several species of understory shrubs and forbs including poison oak, manzanita, California wild rose, and lupine. The reservoir rim is mostly devoid of vegetation as a result of regular and frequent fluctuations in water elevations. Wildlife consists of species that typically use oak woodlands and chaparral habitats in the Central Valley. In addition, large number of waterfowl and gulls overwinter at Thermalito Afterbay, although few use the lake itself.

Sacramento River

Much of the Sacramento River is confined by levees that reduce the natural diversity of riparian vegetation. Agricultural land (rice, dry grains, pastures, orchards, vineyards, and row and truck crops) is common along the lower reaches of the Sacramento River, but is less common in the upper portions. The bands of riparian vegetation that occur along the Sacramento River are similar to those found along the lower American River, but are somewhat narrower and not as botanically diverse. The riparian communities consist of Valley oak, cottonwood, wild grape, box elder (*Acer negundo*), elderberry (*Sambucus mexicanus*), and willow. The largest and most significant tract of riparian forest remaining on the Sacramento River is a stretch between Chico Landing and Red Bluff. Freshwater, emergent wetlands occur in the slow moving backwaters and are primarily dominated by tules (*Scirpus acutus* var. *occidentalis*), cattails, rushes, and sedges (SAFCA and Reclamation 1994). Although riparian vegetation occurs along the Sacramento River, these areas are confined to narrow bands between the river and the river side of the levee.

The wildlife species inhabiting the riparian habitats along the lower Sacramento River are essentially the same as those found along the lower American River. These include, but are not limited to, wood duck, great blue heron, great egret, green heron, black phoebe (*Sayornis nigricans*), ash-throated flycatcher, sora (*Porzana carolina*), great horned owl, Swainson's hawk (*Buteo swainsoni*), California ground squirrel, and coyote. The freshwater/emergent wetlands represent habitat for many wildlife species, including reptiles and amphibians such as the western pond turtle, bullfrog, and Pacific tree frog. Agricultural areas adjacent to the river also represent foraging habitat for many raptor species.

Sacramento – San Joaquin Delta

Most of the vegetation in the Delta consists of irrigated agricultural fields and associated ruderal (disturbed), non-native vegetation fringes that border cultivated fields. Throughout much of the Delta, these areas border the levees of various sloughs, channels, and other waterways within the historic floodplain. Native habitats include remnant riparian vegetation that persists in some areas, with brackish and freshwater marshes also being present. Saline wetlands consist of pickleweed (*Salicornia virginica*), cord grass (*Spartina* sp.), glasswort (*Salicornia* sp.), saltgrass (*Distichlis spicata*), sea lavender (*Limonium californicum*), arrow grass (*Triglochin* spp.), and shoregrass (*Monanthochloe littoralis*). These wetlands are very sensitive to fluctuations in water salinity, which are determined by water flows into the Delta (San Francisco Estuary Project 1993).

There are pockets of water where old channels of the river have been cut off or dredger mining activities have left deep depressions. These backwater areas typically contain large open water areas with a fringe of emergent and isolated vernal pools with a fringe of emergent marsh plants such as cattails and rushes. The calm waters provide excellent habitat for ducks such as cinnamon teal, American wigeon and mallard.

The wetlands of the Delta represent habitat for a number of shorebirds and waterfowl species including killdeer, California black rail (*Laterallus jamaicensis coturniculus*), western sandpiper (*Calidris mauri*), long-billed curlew (*Numenius americanus*), greater yellow-legs (*Tringa melanoleuca*), American coot (*Fulica americana*), American wigeon (*Anas americana*), gadwall (*Anas strepera*), mallard, canvasback (*Aythya valisineria*), and common moorhen (*Gallinula chloropus*). These areas also support a number of mammals such as coyote, gray fox, muskrat, river otter, and beaver. Several species of reptiles and amphibians also occur in this region.

The complex interface between land and water in the Delta has led to a rich and varied plant life that provides habitat for wildlife, especially birds. Wildlife habitats include agricultural land, riparian forest, riparian scrub-shrub, emergent freshwater marsh, heavily shaded riverine aquatic, and grassland/rangeland. Many species that either are listed or are candidates for listing as rare, threatened, and endangered inhabit the Delta, but none are confined exclusively to that area.

San Luis Reservoir

Habitat types found at San Luis Reservoir include lacustrine, riparian, and scattered blue oak woodlands. Riparian habitat is limited to scattered patches of mule fat and occasional willows. Blue oak woodlands occur on the western shore of the reservoir.

South-of-Delta Groundwater Banks

Groundwater recharge basins associated with groundwater banks provide habitat for waterfowl, wading birds and shorebirds.

4.5.2 IMPACT ASSESSMENT METHODOLOGY

The analysis of potential effects on wildlife and vegetation associated with the proposed water transfer within the affected water bodies was based on the following criteria:

- Decrease in river flow, relative to the without-transfer condition, of sufficient magnitude and duration for any given month to adversely affect river corridor riparian habitat or other sensitive natural communities and associated species.
- Decrease in reservoir water surface elevation, relative to the without-transfer condition, of sufficient magnitude and duration, to adversely affect reservoir near-shore habitat and associated species.

The anticipated change in reservoir water surface elevation and river flows were evaluated to determine the likelihood that decreases in reservoir water surface elevations of sufficient magnitude and duration would occur and result in adverse effects to reservoir near-shore or riparian habitat, or river corridor riparian habitat or other sensitive natural community and associated special-status wildlife species.

4.5.3 IMPACT ASSESSMENT

Yuba River

Under the proposed water transfer, flows in the Yuba River below New Bullards Bar Reservoir would be expected to be higher than the without-transfer condition under both the maximum and minimum transfer scenarios. There would be no decrease in flows in the lower Yuba River, relative to the without-transfer condition. Because there would be no decrease in flow under the proposed water transfer, relative to the without-transfer condition, there would be no adverse or unreasonable impacts to the wildlife and vegetation of the riparian corridor of the lower Yuba River.

New Bullards Bar Reservoir

Although New Bullards Bar Reservoir supports a pair of nesting southern bald eagles, the proposed transfer is expected to have no unreasonable impact on bald eagles. Young bald eagles typically fledge and leave the nest and the reservoir areas by late June or early July. The proposed transfer will not begin to have substantive effects on reservoir elevations or river flows until July 1 or later, which is close to when any young bald eagles will have left the area. In addition, the reservoir drawdown associated with the proposed transfer, under either the maximum or minimum transfer scenario, would be within historical and recent operation levels. The reductions in reservoir levels resulting from the proposed transfer would not be large enough to either substantially affect prey fish populations or substantially increase the distance from the nest to the reservoir surface. The change in reservoir levels associated with the proposed transfer is not expected to adversely or unreasonably affect foraging success of bald eagle.

Additionally, although water surface elevation reductions are anticipated with the proposed water transfer, these decreases would not adversely affect the vegetation and wildlife at New Bullards Bar Reservoir because the anticipated lower surface water elevations at New Bullards Bar Reservoir would be within historical operation limits, would not go below the minimum drawdown zone and, therefore, would not be expected to degrade or decrease any moderate to high value vegetation or wildlife habitat.

Surface Streams and Wetlands

In the past, CDFG has expressed concern regarding the potential effects of the groundwater substitution component of YCWA water transfers to potentially affect surface streams and wetlands due to surface-groundwater interactions. This topic is addressed in the Groundwater Resources section of this environmental analysis.

Feather River

Flows within the lower Sacramento River may be higher under either the maximum or minimum transfer scenario during the proposed water transfer, but are anticipated to remain within the range of normal flow ranges and fluctuations resulting from SWP and CVP operations. Specific operations of the Sacramento River system as a result of this proposed water transfer are presently uncertain. However, the potential slight increase in flows is not expected to adversely affect the vegetation and wildlife communities along the lower Sacramento River, relative to the "without-transfer" condition.

Lake Oroville

Lake Oroville water levels would not be anticipated to be substantially affected by the proposed water transfer, under either the maximum or minimum transfer scenario and, thus, the water transfer condition, relative to the without-transfer condition, would not result in unreasonable wildlife or vegetation impacts at Lake Oroville. Ultimately, operation of Lake Oroville would remain within normal operational parameters. Special-status species would not be adversely or unreasonably affected by the proposed transfer, relative to the without-transfer condition.

Sacramento River

Flows within the lower Sacramento River under either the maximum or minimum transfer scenario may be higher during the proposed water transfer, but are anticipated to remain within the range of normal flow ranges and fluctuations resulting from SWP and CVP operations.

Specific operations of the Sacramento River system as a result of this proposed water transfer are presently uncertain. However, the potential slight increase in flows is not expected to adversely affect the vegetation and wildlife communities along the lower Sacramento River, relative to the "without-transfer" condition.

Sacramento-San Joaquin Delta

Flows within the Sacramento-San Joaquin Delta may be slightly higher under either the maximum or minimum transfer scenario during the proposed transfer, but would remain within the range of normal flow ranges and fluctuations resulting from SWP and CVP operations. Specific operations of the Delta system as a result of this proposed water transfer are presently uncertain, although the potential slight increase in Delta inflow is not expected to adversely affect the vegetation and wildlife communities within the Sacramento-San Joaquin Delta, relative to the without-transfer condition.

San Luis Reservoir

It is anticipated that DWR would store a portion of the water transfer water in San Luis Reservoir. The transfer water, under either the maximum or minimum transfer scenario, potentially could provide a slight beneficial effect upon near-shore habitat areas through increased water level elevations, relative to the without-transfer condition. Drawdown of San Luis Reservoir for the purpose of delivering the transfer water would be expected to occur within normal SWP/CVP operational practices for the reservoir and according to existing regulatory requirements or limitations. Therefore, the proposed water transfer is not expected to result in unreasonable impacts to wildlife or vegetation associations of San Luis Reservoir, relative to the without-transfer condition.

South of Delta Groundwater Banks – Groundwater Recharge Basins

The spreading of water in recharge basins for storage in groundwater banks, if groundwater banking of transfer water occurs, would temporarily increase habitat for water fowl, wading birds and shorebirds.

No additional areas would be flooded or inundated as a result of the proposed transfer. The transfer would also not develop or cultivate any native untilled land. Overall, there would not be any unreasonable impacts on any wildlife or vegetation in the areas affected by the transfer. There would be no unreasonable impacts on any state or federal special status animal or plant species.

4.6 RECREATION

Recreational activities at reservoirs or rivers within the study area could be affected by changes in water operations associated with the proposed maximum or minimum water transfer scenarios. Changes in reservoir storage or water surface elevation levels at New Bullards Bar Reservoir, Lake Oroville or San Luis Reservoir could affect swimming, boating, water-skiing, or other water-based activities at the individual reservoirs. Reservoir storage at these reservoirs normally varies throughout the year due to water releases made for agricultural, urban, and environmental needs and the necessity to have a designated volume available to store runoff during winter and spring (flood control). Recreation activities along or within the Yuba, Feather, and Sacramento river corridors and the Delta that could be affected by the proposed water transfer include swimming, boating, boat and shore fishing, beach use, camping, and picnicking.

4.6.1 ENVIRONMENTAL SETTING

4.6.1.1 Yuba River

Numerous rivers, creeks, tributaries, and reservoirs along the Yuba River offer recreation opportunities and receive extensive use. Boating in the Yuba River is limited because of poor access; boats must be hand-carried to the river. Where access is available, fishing, picnicking, rafting, tubing, and swimming are the dominant recreational uses. The Yuba River offers excellent American shad, Chinook salmon, and steelhead fishing (DWR and Reclamation 2003).

4.6.1.2 New Bullards Bar Reservoir

New Bullards Bar Reservoir recreation facilities are managed by the U.S. Forest Service (USFS). Popular recreation activities include boating, fishing, and camping. Over 20 miles of hiking and mountain biking trails existing in the area, including Bullards Bar Trail, which runs along the perimeter of the lake. Several campgrounds, including Schoolhouse and Dark Day, are in the vicinity. Some campgrounds around the reservoir, such as Madrone Cove and Garden Point, are accessible only by boat. Emerald Cove Resort and Marina is a floating marina that is operable at all lake levels. The marina offers a general store, pumping station, launch ramp, boat rentals, moorage, and annual slips. Boat access to the reservoir is provided by the Cottage Creek boat ramp (at Emerald Cove Marina) and Dark Day boat ramp. Cottage Creek boat ramp is unusable when lake level falls below 1,822 feet above msl, and Dark Day boat ramp becomes inoperable when the lake level falls below 1,798 feet above msl (Onken 2003 *as cited in* DWR and Reclamation 2003). Low reservoir levels affect day swimming areas and boat-in campgrounds before boat ramps are affected. Some boat launchings occur year-round; however, the typical boating season extends from about early May through mid-October. The heaviest use of the ramps occurs on weekends and holidays from Memorial Day to Labor Day (USDA Forest Service 1999 *as cited in* DWR and Reclamation 2003). Fishing also is a popular recreational activity; species found in the reservoir include rainbow trout, brown trout, Kokanee salmon, smallmouth bass, largemouth bass, bluegill, crappie, and bullhead catfish.

4.6.1.3 Feather River

Feather River recreational activities include swimming, fishing, camping, bird-watching, picnicking, and bicycling. Rafting on the North and Middle forks of the Feather River runs from January to April or May, depending on flow. Summer rafting and kayaking occurs on the North Fork depending on upstream PG&E reservoir operations. Recreational activities along the Low Flow Channel reach of the Feather River include fishing, sightseeing, hiking, bicycling and wildlife and bird-watching. The Oroville Wildlife Area, downstream of the Thermalito Afterbay outlet, provides opportunities for bird-watching, in-season hunting, fishing, swimming, and camping.

4.6.1.4 Lake Oroville

The California Department of Parks and Recreation (CDPR) manages the recreation facilities of the Lake Oroville complex. Lake Oroville has a surface area of approximately 15,800 acres and a shoreline of 167 miles when full (SWRCB 1997). The peak recreation season is from late spring through summer.

Lake Oroville has two full-service marinas, nine parks provide facilities for baseball, tennis, swimming, and picnicking within the vicinity of the lake. There are major boat launch ramps at Bidwell Canyon, Loafer Creek, and Lime Saddle (DWR 2001b). The spillway has an 8-lane and 12-lane boat ramp in two stages. Construction of extensions on boat ramps at Bidwell Canyon, the Spillway, and Lime Saddle allow the ramps to remain open when lake elevations remain at or greater than 700 feet above msl (DWR and Reclamation 2003). Average water surface elevation in Lake Oroville historically has been between 817 and 787 feet above msl between July and September, respectively. Although boat ramps remain usable, lower lake elevations can adversely affect swimming beaches and boat-in campgrounds (Sherman 2003 *as cited in* DWR and Reclamation 2003). The Lake Oroville State Recreation Area provides camping, picnicking, boating, fishing, hunting, horseback riding, hiking, bicycling, sightseeing, and a variety of other activities. Major facilities in the state recreation area include Loafer Creek, Bidwell Canyon, Spillway, Lime Saddle, Lake Oroville Visitor Center, and North and South Thermalito Forebay. The state recreation area also provides several less-developed car-top launching areas, boat-in campsites, and floating campsites on Lake Oroville. DWR maintains three launch ramps and a day-use area at the Oroville Wildlife Area, which includes Thermalito Afterbay.

4.6.1.5 Sacramento River

On the upper Sacramento River, water-dependent activities (e.g., swimming, boating, and fishing) account for approximately 52 percent of the recreation uses (SCWA and Reclamation 1997 *as cited in* Reclamation 2001a). Fishing, rafting, canoeing, kayaking, swimming, and power boating are available along most of the upper Sacramento River. While fishing is a year-round activity, boating, rafting, and swimming use take place primarily in summer months when air temperatures are high. Between Colusa and Sacramento, major recreation facilities are located at Colusa-Sacramento River Recreation Area, Colusa Weir access, Tisdale Weir access, River Bend Boating Facility, Knights Landing, Sacramento Bypass, and Elkhorn Boating Facility.

Recreational use of the lower Sacramento River, between the American River confluence and the Delta, is closely associated with recreational use of Delta waterways. This section of the river, influenced by tidal action similar to the Delta, is an important boating and fishing area with several private marinas located on the river.

4.6.1.6 Sacramento-San Joaquin Delta

As a complex of waterways affected by both freshwater inflows and tidal action, the Delta is a very important recreation resource that provides a variety of water-dependent and water-enhanced recreation opportunities. Boating is the most popular activity in the Delta region, accounting for approximately 17 percent of visitation, with other popular uses including fishing, relaxing, sightseeing, and camping (DWR and Reclamation 1996). Boating and related facilities are located throughout the Delta and include launch ramps, marinas, boat rentals, swimming areas, camping sites, dining and lodging facilities, and marine supply stores. Most recreation facilities are privately owned and operated commercially.

Located near several metropolitan areas, the Delta supports about 12 million user days of recreation a year (DWR 1993). Parks along the mainstem of the Sacramento River and Delta sloughs provide access for water-oriented recreation as well as picnic sites and camping areas. Brannan Island State Park and Delta Meadows River Park are major water-oriented recreational areas. Use of these parks typically peak in July.

4.6.1.7 San Luis Reservoir

San Luis Reservoir State Recreation Area (SRA) is open year-round and provides activities including boating, waterskiing, fishing, camping, and picnicking. Boat access is available via one boat ramp at the Basalt area at the southeastern portion of the reservoir and at Dinosaur Point on at the northwestern portion of the reservoir. The boat ramp at Basalt becomes difficult to use because of low reservoir levels at elevation 340 feet above msl; the boat ramp at Dinosaur Point is difficult to access at elevation 360 feet above msl (San Joaquin River Group 1999 *as cited in* DWR and Reclamation 2003). There are no designated swimming areas or beaches at San Luis Reservoir.

4.6.2 IMPACT ASSESSMENT METHODOLOGY

The analysis of the potential effects on recreation opportunities associated with the proposed water transfer was based on the following criteria:

- Changes in reservoir water levels or river flows, relative to the without-transfer condition, of sufficient magnitude and duration for a given month, to adversely affect (substantially reduce) recreational opportunities.

- Changes of river water temperature, relative to the without-transfer condition, of sufficient magnitude and duration for a given month, to adversely affect recreational swimming, tubing, canoeing, kayaking and rafting.

- Reduction in reservoir water levels, relative to the without-transfer condition, of sufficient magnitude and duration, such that boat ramps become unusable.

4.6.3 IMPACT ASSESSMENT

4.6.3.1 Yuba River

River flows on the Yuba River would be higher during either the maximum or minimum water transfer scenario, but within the range of normal flow levels and fluctuations. Any impacts on river recreation activities would be minimal and slightly beneficial. The increased flows could benefit rafting and other boating opportunities. Angling opportunities on the Yuba River may be enhanced by the greater water volumes and decreased water temperatures during the proposed transfer. The proposed ramping rates have been developed with consideration of overall safety concerns for anglers and other recreationists. As with other past transfers on the Yuba River, no unreasonable impacts on recreation, including angling, are expected to occur as a result of the proposed transfer.

4.6.3.2 New Bullards Bar Reservoir

New Bullards Bar Reservoir elevations could decrease below without-transfer elevations by up to 28 feet under the maximum water transfer scenario, or by up to 15 feet under the minimum water transfer scenario (Appendix A). By mid-October, New Bullards Bar Reservoir surface water elevations potentially would decrease from an approximately 1,896-foot elevation (without the transfer) to approximately 1,868 feet msl (maximum transfer scenario) or 1,881 feet msl (minimum transfer scenario). Cottage Creek boat ramp is unusable when the lake level is below 1,822 feet above msl, and Dark Day boat ramp is unusable when the lake level is below 1,798 feet above msl. Emerald Cove Marina is operable at all lake levels. Therefore, based on the anticipated level of reduction in surface water levels under both the maximum and minimum water transfer scenarios, the proposed water transfer would not affect operation of New Bullards Bar Reservoir boat ramps. Although other recreational uses may decline somewhat with lower reservoir elevations, these affects are typical in many water years and are not considered to be unreasonable.

4.6.3.3 Feather River

Flows in the Feather River potentially would be higher under proposed maximum or minimum water transfer scenarios relative to without-transfer conditions. Increased flows potentially would improve recreational opportunities in summer and early fall months. Overall, the range of flows anticipated under the proposed water transfer in the Feather River would be within normal operating ranges and would not be expected to result in unreasonable impacts to recreation opportunities of the Feather River.

4.6.3.4 Lake Oroville

Water levels in Lake Oroville during the primary recreation season (May through September) would not be anticipated to be affected by the proposed water transfer scenarios, relative to the without-transfer conditions. Therefore, the proposed water transfer would not result in unreasonable impacts upon recreation activities at Lake Oroville.

4.6.3.5 Sacramento River

Flows within the lower Sacramento River may be higher during the proposed maximum or minimum water transfer scenarios but are anticipated to remain within the range of normal flow ranges and fluctuations resulting from SWP and CVP operations. Although specific operations of the Sacramento River system as a result of this proposed water transfer are uncertain, the potential slight increases in flow are not expected to adversely affect recreation, relative to the without-transfer condition, and may be slightly beneficial. Also, the slight increase in flows would not affect water temperatures in the Sacramento River and, therefore, would not reduce the recreational opportunities on the Sacramento River.

4.6.3.6 Sacramento-San Joaquin Delta

Flows within the Delta may be slightly higher during the proposed maximum or minimum water transfer scenarios, but are anticipated to remain within the range of normal flow ranges and fluctuations resulting from SWP and CVP operations. Although specific operations of the Delta system are uncertain as a result of this proposed water transfer, the potential slight increases in flow are not expected to adversely affect recreation, relative to the without-transfer condition.

4.6.3.7 San Luis Reservoir

DWR potentially would store some portion of the transferred water at San Luis Reservoir. Increased storage levels at San Luis Reservoir therefore could be anticipated during primary recreational months (May through September) and may provide a beneficial effect upon recreational opportunities at the reservoir. The proposed water transfer would not be anticipated to result in unreasonable impacts upon recreation activities at San Luis Reservoir.

4.6.3.8 Groundwater Recharge Basins

The groundwater recharge basins located south of the Delta provide habitat for waterfowl and water birds and provide opportunities for bird watching. The potential increase in water stored in south-of-Delta groundwater banks could possibly increase habitat for waterfowl and water birds at the recharge basins, thereby increasing opportunities for bird-watching at these locations.

4.7 OTHER ENVIRONMENTAL RESOURCE ISSUES

4.7.1 AIR QUALITY

The proposed groundwater substitution component of the proposed 2005 water transfer has the potential to result in air quality impacts related to the generation of criteria pollutants from fossil-fueled pumps. The EWA EIS/EIR (DWR and Reclamation 2003) presents a detailed analysis of potential air quality effects associated with groundwater substitution practices, and includes mitigation measures to ensure avoidance of significant air quality impacts.

The proposed water transfer from YCWA to DWR for EWA purposes specifically would be conducted in compliance with the mitigation requirements included in the Record of Decision for the EWA. In particular, YCWA groundwater substitution water would be delivered only from wells approved by DWR for use in the water transfer for EWA purposes (i.e., wells fitted with electric or other non-diesel fueled pumps).

Because the proposed water transfer is statutorily exempt from CEQA, potential for air quality impacts associated with groundwater pumping for uses outside of the EWA program are not of concern for this proposed temporary action.

4.7.2 CULTURAL RESOURCES

Drawdown of water from New Bullards Bar Reservoir for the purposes of providing transfer water to the EWA program is subject to consideration under Section 106 of the National Historic Preservation Act as discussed in the EWA EIS/EIR (DWR and Reclamation 2003). The proposed water transfer is not anticipated to result in water elevations in New Bullards Bar Reservoir lower than historic normal operations and, therefore, would not result in creation of a new drawdown zone. Potential impacts upon cultural resources due to potential exposure of formerly unexposed resources beneath the water would be avoided during the 2005 water transfer.

4.8 CARRYOVER STORAGE

Downstream flow impacts can result when water has been released from reservoir storage for transfer purposes and the storage volume subsequently must be refilled with incoming water that otherwise would be spilled or bypassed. The reduction in spills or bypass flows could reduce flows downstream of the reservoir by as much as the quantity of the transferred amount of water. Any analysis of storage refill (carryover storage) effects is highly speculative because these potential impacts are directly related to future water conditions that cannot be accurately predicted. Water management decisions in California are based on daily conditions occurring in a variety of water-year types, and specific management decisions for future years are difficult to forecast; therefore, the following discussion is considered speculative and based on hypothetical situations.

4.8.1 IMPACT ASSESSMENT

The proposed YCWA water transfer would result in a minimum of a 62,000 acre-feet reduction and a maximum of up to a 100,000 acre-feet reduction in storage in New Bullards Bar Reservoir by the mid-October 2005, and could affect the probability, or at least the timing and duration, of spilling in water year 2006 (or subsequent water years, if no spilling occurs in 2006). Spills would not occur as early, or may be smaller, under the with-transfer conditions compared to the without-transfer conditions. Consequently, Yuba River flows could be lower than they would be under without-transfer conditions for some duration of time, most likely in winter or spring. Even in this situation, however, all required minimum instream flow requirements would be met.

If water year 2006 is a dry or critically dry year, it is possible that no spilling would take place regardless of whether the proposed transfer occurs; thus, potential impacts of a transfer on storage refill could be delayed into subsequent water years. If water year 2006 is a below-normal water year, the potential storage refill effects of a transfer would be largest because some spilling (a marginal amount) would be likely under without-transfer conditions. If water year 2006 were an above-normal or wet water year, potential storage refill effects likely would be minor because of the large quantity of spilling that probably would occur, regardless of whether the transfer is implemented. However, it is difficult to predict storage refill effects even with respect to water-year types because substantial spilling could occur even in a dry water year.

Storage refill effects for the proposed transfer are not considered to be unreasonable given the speculative nature of the potential impacts, and the maintenance of minimum instream flow requirements at all times regardless of when storage refill effects may occur. Additionally, SWRCB's Yuba River instream flow requirements specified in RD-1644 would require reservoir releases greater than the volume of the proposed transfer, and the potential effects of this transfer would be smaller than those of the releases that would be made to satisfy the RD-1644 requirements. Overall, the effects of operations under the proposed transfer would not be considered unreasonable.

5.0 CUMULATIVE IMPACTS

5.1 INTRODUCTION

Cumulative effects are considered for the incremental effect of the proposed water transfer when added to other past, present, and reasonably foreseeable future actions, regardless of which agency or entity undertakes them. Cumulative effects can result from individually minor, but collectively significant, actions taking place over time. As discussed previously, BVID intends to transfer 3,100 acre-feet of water to SCVWD during the first two weeks of October 2005. Anticipated flows associated with this transfer are depicted in the Hydrologic Analysis (Appendix A) and considered throughout this Environmental Analysis. CALFED Program actions, Central Valley Project Improvement Act (CVPIA) actions, and ongoing SWP and CVP operations and actions, in particular, are all highly adaptable programs subject to great change as hydrologic, environmental, regulatory, and water supply conditions change. Because the proposed water transfer increases operational flexibility of DWR's programs (EWA and Dry Year Water Purchase), the analysis of cumulative effects is necessarily speculative and general. However, it must be recognized that this flexibility provides an operational buffer for avoidance of adverse cumulative impacts.

Ongoing operations of YCWA, SWP, CVP, CALFED's Operations Group, and water contractors are complex and part of the affected environment. Both SWP and CVP consist of a complex network of reservoirs and delivery systems. SWP and CVP management decisions to provide water for water contractors require the balancing of water for irrigation and domestic water supplies, fish and wildlife protection, restoration and mitigation and hydropower generation. In developing operations decisions, YCWA, DWR, and Reclamation collectively use criteria related to reservoir operations and storage, downstream conditions and needs, prevailing water rights, environmental requirements, flood control requirements, carryover storage objectives, reservoir recreation, hydropower production capabilities, cold water reserves, pumping costs, contract requirements, and other factors. The possibility of using multiple water sources for some requirements and environmental opportunities add flexibility to project operations and complexity to operations decisions.

DWR and Reclamation are participants in several statewide programs that currently involve or will involve water transfers from stored surface water, groundwater substitution, or farmland fallowing practices. These include CALFED programs, such as EWA and Environmental Water Program, DWR's Dry Year Water Purchase Program, and the state-proposed Critical Water Shortage Reduction Marketing Program. Programs such as the EWA and the proposed Critical Water Shortage Reduction Marketing Program are intended to result in beneficial water supply and environmental effects, including increased instream flows in source areas and increased water levels in SWP/CVP reservoirs.

5.2 OTHER RELATED PROJECTS

The EWA for 2005 likely will include upstream acquisitions, stored water, and 2004 carryover surface supply. In addition to the EWA, DWR's Dry Year Water Purchase Program and the Critical Water Shortage Contingency Plan (if needed), CALFED's Environmental Water

Program, and Reclamation's CVPIA Level 4 Wildlife Refuge Water Purchase Program may need to acquire north of the Delta water supply options during 2005. These programs will need to be coordinated between DWR and Reclamation. Some of the information presented below is based on the recent DWR and Reclamation water purchase agreement for the EWA (DWR and Reclamation 2002).

5.2.1 CALFED EWA – OTHER ACQUISITIONS

5.2.1.1 2001-2004 EWA Water Transfers

Under the EWA, assets acquired will be used to efficiently manage water for environmental purposes while decreasing conflicts in use of water in the Bay-Delta estuary. With a more flexible means of managing water operations available, existing fish protection measures and the implementation of the EWA will achieve substantial fish recovery opportunities while providing improvements in water supply reliability and water quality. DWR has been successful in creating water assets of over 150,000 to more than 200,000 acre-feet annually in 2001 through 2003.

5.2.1.2 2005 EWA Water Transfers

5.2.2 DWR DRY YEAR WATER PURCHASE PROGRAM ACQUISITIONS

In 2001 and 2002, the Dry Year Water Purchase Program acquired approximately 138,800 acre-feet and 22,000 acre-feet of water, respectively (EDAW 2004). DWR initiated the Dry Year Program for 2003 and 2004, but water purchases were lower (11,355 and 487 acre-feet, respectively) (DWR 2005a; DWR 2005b). In August 2004, DWR announced its plans to implement the Dry Year Program in 2005. The program is open to all agencies and is intended to reduce the possibility of adverse economic impacts and hardship associated with water supply shortages. The quantity of water to be acquired in any year is unknown and depends on requests made by participants, if any, in the Dry Year Water Purchase Program, what options are exercised in their contracts, available SWP pumping capacity and environmental conditions in the Delta. Much of this water is purchased from north of the Delta during dry years.

5.2.3 DWR CRITICAL WATER SHORTAGE CONTINGENCY PLAN

The Critical Water Storage Contingency Plan was prepared in response to the commitment in the CALFED ROD that California's governor would convene a panel to develop a "contingency plan to reduce the impacts of critical water shortages primarily for agricultural and urban water users." The Critical Water Storage Contingency Plan identified all available resources (e.g., water transfers, water exchanges, groundwater programs, and local partnerships), building upon the experience gained with the governor's Drought Water Bank, to minimize such shortages.

DWR received $10.5 million in the 2002 fiscal year to implement programs recommended by the panel: financial assistance to local agencies preparing Assembly Bill 303 plans and integrated water management plans; technical assistance for small water systems and rural homeowners with private wells; new groundwater data collection; and preparation of a programmatic environmental impact report for a critical water shortage purchasing program. DWR is proceeding with these activities as well as with an outreach program as recommended by the panel.

5.2.4 CALFED Environmental Water Program

The Environmental Water Program is a developing program that seeks to acquire water to assist in carrying out the goals of CALFED's Ecosystem Restoration Program Plan. The program is in its infancy and is not expected to result in any water transactions in 2005.

5.2.5 Reclamation CVPIA Level 4 Wildlife Refuge Water Purchase Program

CVPIA requires the U.S. Department of Interior (Interior) to acquire additional water supplies to meet optimal waterfowl habitat management needs at national wildlife refuges in California's Central Valley, certain state wildlife management areas, and the Grassland Resource Conservation District (collectively know as refuges). The optimum water supply levels are referred to as Level 4. The annual water acquisition goal is 163,000 acre-feet to meet full Level 4 requirements at the refuges. Typical annual water acquisition needs are lower because refuge water supplies are partially met in most years by rainfall, runoff, and/or local supplies (Reclamation 2005). For the 2003 contract year (March 2003 through February 2004), 70,000 acre-feet were acquired (DWR 2005 c).

5.2.6 Sacramento Valley Water Management Program Short-term Agreement

Phase 8 of the SWRCB's Bay-Delta water rights proceedings has evolved to a settlement between DWR, Reclamation, export interests, and certain water rights holders in the Sacramento Valley, including YCWA. This settlement has resulted in a short-term agreement between the parties. As part of the short-term agreement, YCWA has agreed to provide 15,000 acre-feet of water for the program in dry years. The water would be made available through groundwater substitution.

5.2.7 Other Water Transfers

Other water transfers between currently unknown and unidentified parties also may be proposed and undertaken in 2005. YCWA currently is not considering any other water transfers for 2005, however Brown's Valley Irrigation District plans to transfer 3,100 acre-feet of water to the Santa Clara Valley Water District in October 2005 (Appendix A). There is a high likelihood that other local or regional transfers may occur in the Sacramento Valley and Delta in 2005 that cannot be identified at this time. For example, the Metropolitan Water District of Southern California (MWD) received offers from several Sacramento Valley water districts to sell water in 2004 and is considering options for 2005. Also in 2003, Reclamation released an Environmental Assessment to comply with NEPA to cover eight Sacramento River contractors desiring to transfer up to 110,000 acre-feet of water to MWD, DWR for its Dry Year Water Purchase Program, CALFED's EWA, or other CVP or SWP contractors (Reclamation 2003). These transfers would not affect the Yuba or Feather rivers, but would increase flows in the Sacramento River during July through September.

5.3 POTENTIAL CUMULATIVE IMPACTS

5.3.1 YUBA RIVER

YCWA in prior years has undertaken transfers similar to the proposed 2005 temporary water transfer and has prepared environmental documentation for each transfer (Reclamation 1997 and 1999; EDAW 2001, 2002, 2003, 2004). These past evaluations and subsequent review of the water transfer effects (JSA 2002; SWRI and JSA 2003; SWRI 2005), have not conclusively identified any significant adverse or unreasonable environmental impacts upon legal users of the water or upon fish, wildlife, vegetation, recreation, or other beneficial uses of the water. Yuba River Chinook salmon population trends have continued to be maintained or increased over time, including during periods of water transfers. For example, the 2001-2003 Yuba River salmon spawning escapements were approximately 23,000 to 29,000 salmon in each year, well above the average annual escapement levels over the past 45 years. The most recent 8-year period of escapement records (1996 through 2003) is higher than any other 8-year period of Chinook salmon escapement on the Yuba River since data have been collected (over the past 50 years).

Fisheries monitoring programs instituted in 2001, 2002 and 2004 to collect data regarding YCWA's water transfer effects on fisheries found no conclusive evidence of adverse impacts (JSA 2002; SWRI and JSA 2003; SWRI 2005). While much of the existing information is inconclusive, protections such as minimizing fluctuation during spawning periods and implementing ramping rates at the end of transfers have reduced the potential for unreasonable adverse effects on Yuba River fisheries.

5.3.2 SACRAMENTO-SAN JOAQUIN DELTA AND ENVIRONMENTAL WATER ACCOUNT

The EWA will allow further curtailment of Delta pumping to reduce the entrainment of fish at the SWP Banks Pumping Plant to achieve benefits beyond the existing environmental baseline. Pumping could be increased to move water controlled by the EWA when substantial impacts on sensitive fish are not likely to occur. However, the ultimate/final pumping pattern will remain within the possible patterns that the SWP is allowed under the existing SWRCB Delta Water Quality Control Plan.

Most water transfers likely will be exported through the Delta during summer and fall months to maximize benefits to migrating winter-run Chinook salmon and minimize adverse effects on delta smelt. The EWA is expected to make relatively small changes in the overall operations of the SWP and CVP facilities. Operational changes to the SWP and CVP in 2005 generally can be characterized as shifts in pumping rates at the SWP and CVP Delta diversion pumps, shifts in storage and release patterns at SWP/CVP reservoirs, shifts in groundwater pumping in local areas, and shifts in surface water storage release patterns in local areas. Overall, programs such as the EWA, the Dry Year Water Purchase Program, and the Critical Water Shortage Reduction Marketing Program will benefit instream resources by reducing Delta pumping and the entrainment of fish at the Delta pumping plants. Programs such as the EWA will rely primarily on surface water in wet years and shift to reliance on groundwater in dry years.

The EWA transfer from YCWA may affect Lake Oroville storage levels if releases have to be made to prevent water quality impacts in the Delta during the period when New Bullards Bar

Reservoir is being refilled. Changes in storage levels and release patterns at Lake Oroville also may result from changes in operations at the Banks Pumping Plan in the Delta as a result of other EWA projects. In most instances, changes in operations would lead to temporary increases in reservoir storage levels. In some instances, the EWA could borrow water from upstream reservoirs, (i.e., Shasta Reservoir on the Sacramento River) thereby lowering reservoir storage levels.

The nature of the EWA program, specifically acquisition of up to approximately 200,000 acre-feet of water annually from various sources, along with the regulatory framework currently in place, makes the potential for significant and/or unreasonable adverse cumulative impacts during 2005 implementation and over the life of the proposed program highly unlikely. The EWA program is being implemented and will be adaptively managed to actually maintain and/or benefit both Delta fisheries and contractor water supplies.

Early in 2001, DWR prepared an environmental document addressing the specific impacts from implementing the Year 2001 Water Transfer Agreement between YCWA and DWR for support of CALFED's EWA (DWR 2001). This document can be reviewed for additional background information on the larger program of establishing numerous other individual assets to create the EWA, as specified in the CALFED ROD, dated August 28, 2000. Additional environmental documents were prepared annually for additional assets, as appropriate. In 2004, the EWA Final EIR/EIS was released, which evaluated numerous transfer scenarios including transfers from YCWA to Delta users. The conclusion in the Final EIR/EIS and by the USFWS and NMFS was that the EWA transfers would not likely adversely affect delta smelt, Sacramento River winter-run Chinook salmon and critical habitat, Central Valley spring-run Chinook salmon, and Central Valley steelhead (Reclamation and DWR 2004; USFWS 2004; NMFS 2004).

5.4 CONCLUSION

For the proposed 2005 transfer, cumulative effects are not considered to be unreasonable. Environmental considerations have been strongly integrated into the design of the related projects described above. Salmon populations in the lower Yuba River remain healthy since transfers were first initiated in the late 1980s. Less information is available for steelhead, but there is not conclusive information that demonstrates unreasonable impacts to this species. The regulatory framework currently in place and the use of most of this transfer water for environmental purposes in the EWA also leads to the conclusion that there would be no unreasonable cumulative effects.

6.0 SUMMARY OF UNREASONABLE IMPACTS, MITIGATION MEASURES AND WATER TRANSFER BENEFITS

Potential impacts that could occur within and downstream of the Yuba River watershed were evaluated to determine whether the proposed water transfer would adversely affect surface water and groundwater supply and quality, fisheries resources, wildlife and vegetation, recreation, air quality and cultural resources in the potentially affected water bodies. The proposed water transfer will not result in any adverse effects on the beneficial uses of the Yuba River, Yuba Project, Yuba groundwater sub-basins, Feather River, Lake Oroville, Sacramento River, Delta, San Luis Reservoir or the south-of-Delta groundwater banks. The following sections summarize the determination regarding the potential for unreasonable impacts, describe mitigation measures to be implemented during the proposed 2005 water transfer, and discuss the anticipated benefits of the proposed water transfer.

6.1 UNREASONABLE IMPACTS

The proposed water transfer would not have any unreasonable impacts on any instream beneficial uses of the water bodies involved in the transfer of the water. Similar YCWA water transfers in recent years also have not resulted in any known significant, substantial, or unreasonable impacts to any beneficial uses. These transfers have provided additional water for various uses, including environmental uses and thereby have provided multiple benefits.

6.2 MITIGATION

The environmental assessment determined that there would be no unreasonable impacts associated with the proposed water transfer from YCWA to DWR. Although no specific mitigation actions are required, this section summarizes the measures incorporated into the proposed 2005 water transfer to ensure protection of water supply, groundwater, fisheries, and air quality.

- YCWA and DWR will comply with SWRCB Decision 1641 (D-1641) Tables 1, 2 and 3 to ensure that no unreasonable effects on fish, wildlife or other instream beneficial uses are caused by the addition of the Clifton Court Forebay and the Tracy Pumping Plant as points of rediversion.

- YCWA has voluntarily agreed to cooperate with DWR to investigate any claim of adverse impact on groundwater and to adjust operations as necessary to address any such impact. Additionally, YCWA and DWR will implement a Groundwater Monitoring and Reporting Program.

- YCWA will continue to consult and coordinate with fishery resources agencies regarding the appropriate level of monitoring and reporting for the 2005 water transfer.

- YCWA would provide water obtained through DWR-approved wells for the groundwater substitution component of the 2005 transfer.

6.3 BENEFITS

Benefits that may result from the proposed transfer would include:

- DWR is provided with increased flexibility to meet its water supply and environmental protection obligations.
- YCWA is provided with funds that it will use to meet its multi-objective mission of providing flood control, hydroelectric generation, water supply, and fisheries enhancement and related recreation for Yuba County residents.
- Yuba River water temperatures may be reduced, which may provide slight benefits to anadromous species in the river during the transfer (months).
- September and October flows below Daguerre Point Dam are stabilized, which maintains migration of adult spring-run and fall-run Chinook salmon in the Yuba River, as well as any spawning by adult spring-run and fall-run Chinook salmon;
- The higher river flows would allow for increased rafting and other boating opportunities and, therefore, could increase recreational opportunities.
- The increases in reservoir storage and river flows would increase the potential dilution of contaminants and, therefore, improve the water quality at these locations.

7.0 CONSISTENCY WITH PLANS AND POLICIES

The proposed water transfer would be implemented and consistent with existing plans and policies, as described below.

Coordinated Operations Agreement (DWR/Reclamation)

DWR and Reclamation shall continue to adhere to the general sharing principles contained in the 1986 Coordinated Operations Agreement (COA) as modified by interim operating agreements to reflect changes in regulatory standards, facilities, and operating conditions, including the EWA.

Yuba County Water Agency

- California Water Code §1732
- SWRCB Orders
- FERC License Agreements
- PG&E Power Purchase Agreement

DWR/State Water Project

- South Delta Improvements Program
- Kern Water Bank Operating Plan
- California Department of Health Services Drinking Water Standards
- Article 19 Water Quality Objectives for Long-term SWP Contracts
- 2004 Winter-run Chinook Salmon Biological Opinion for OCAP (NMFS)
- 2004 Delta Smelt Biological Opinion for OCAP (USFWS)
- 2004 Delta Smelt Biological Opinion for the EWA (USFWS)
- 1995 Bay-Delta Water Quality Control Plan

8.0 CONSULTATION AND COORDINATION

YCWA, its legal counsel and/or environmental consultants contacted resources agency personnel regarding the environmental analysis for the proposed 2005 temporary water transfer. This section summarizes the consultations and coordination activities.

Fisheries Resources Agencies

YCWA and technical resource consultants met with resource agency representatives from CDFG, USFWS, and NMFS on two occasions in February 2005 to discuss the proposed 2005 water transfer. On February 9, 2005, YCWA presented the current water year forecast based on Bulletin 120 (forecast as higher range in Below Normal water year type). YCWA also presented preliminary anticipated lower Yuba River flow regimes based on a minimum transfer scenario of 65,000 acre-feet and a maximum transfer scenario of 125,000 acre-feet. On February 15, 2005, YCWA described the probabilities of each transfer scenario based on current water availability forecasts. There were discussions regarding potential fisheries monitoring activities and outlining of preliminary monitoring options, depending upon the water year type and water transfer scenario that occurs in 2005. YCWA indicated that the streamflow and water temperature monitoring at the Smartville and Marysville gages, and water temperature monitoring at Daguerre Point Dam will continue in 2005, as well as annual spawning stock escapement estimation. CDFG and USFWS indicated that they will continue to operate the VAKI RiverWatch system at the Daguerre Point Dam fish ladders, year-round.

Agency and consultant representatives at the two meetings were as follows:

February 9, 2005
John Nelson, CDFG
Duane Massa, CDFG
Cesar Blanco, USFWS
Michael Tucker, NMFS
Curt Aikens, YCWA
Tom Johnson, YCWA
Bob Winchester, YCWA
Paul Bratovich, SWRI
Ben Ransom, SWRI

February 15, 2005
John Nelson, CDFG
Cesar Blanco, USFWS
Michael Tucker, NMFS
Curt Aikens, YCWA
Tom Johnson, YCWA
Paul Bratovich, SWRI
Ben Ransom, SWRI

Central Valley Regional Water Quality Control Board

Mr. Richard McHenry, Senior Water Quality Control Engineer for the RWQCB, was contacted on March 2, 2005 to discuss any potential concerns the RWQCB may have regarding the proposed 2005 water transfer. Mr. McHenry indicated that the RWQCB recently identified the potential for shifts in hardness levels related to water transfers to be of concern and indicated that the Environmental Analysis should provide a description of hardness levels in the potentially affected water bodies. The potential water quality concern is related to the potential for metals to become more readily bioavailable if the hardness level of the receiving water is substantially reduced by introduction of the transfer source water. Therefore, transfer of a high volume of low hardness waters into waters of higher hardness levels potentially could be of concern. Mr.

McHenry and his staff provided data for the Yuba, Feather and Sacramento rivers for use in this discussion. Mr. McHenry indicated that due to the anticipated volume of the transfer (approximate maximum of 1,023 cfs), the available dilution potential as the water transfer flows from the Yuba River to the Feather River, Sacramento River and to the Delta, and the relatively low or "clean" hardness levels of these water bodies, that there likely would not be a water quality concern related to the proposed 2005 water transfer. A discussion of this topic is provided in the water quality assessment.

9.0 REPORT PREPARERS

Yuba County Water Agency

Curt Aikens	General Manager

Surface Water Resources, Inc.

Paul M. Bratovich	Principal Scientist
Tami J. Mihm	Project Manager/Senior Scientist
Jose Perez-Comas	Senior Scientist
Salvador Becerra-Munoz	Associate Scientist
Ben Ransom	Associate Scientist
Amanda O'Connell	Environmental Planner

Montgomery Watson Harza Americas, Inc.

Steve Grinnell	Project Engineer

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