Yuba County
Integrated Regional Water Management Plan

2015 IRWMP UPDATE

YUBA COUNTY
INTEGRATED REGIONAL WATER MANAGEMENT PLAN
2015 UPDATE

COMPLIANCE REVIEW DRAFT

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Yuba County Integrated Regional Water Management Plan
2015 UPDATE

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List of Acronyms

ACWA	Association of California Water Agencies
af	acre-feet
af/ac	acre-feet per acre
af/yr	acre-feet per year
AFRP	Anadromous Fish Restoration Program
AHA	Alliance for Hispanic Advancement
AIS	Aquatic Invasive Species
AML	Abandoned Mine Lands
ARB	American River Basin
Basin Plan	Regional Water Quality Control Basin Plan
Beale AFB	Beale Air Force Base
BMO	Basin Management Objectives
BMPs	Best Management Practices
BVID	Browns Valley Irrigation District
BYLT	Bear Yuba Land Trust
BYSWQC	Butte-Yuba-Sutter Water Quality Coalition
CABY	Cosumnes, American, Bear, Yuba
CAKE	Climate Adaptation Knowledge Exchange
Cal/EPA	California Environmental Protection Agency
CARB	California Air Resources Board
CASGEM	California Statewide Groundwater Elevation Monitoring Database
CDEC	California Data Exchange Center
CDFW	California Department of Fish and Wildlife
CDPH	California Department of Public Health
CEC	California Energy Commission
CEDEN	California Environmental Data Exchange Network
CEQA	California Environmental Quality Act
CERES	California Environmental Resource Evaluation System
CESA	California Endangered Species Act
cfs	cubic feet per second
CFWID	Camp Far West Irrigation District
CNDDB	California Natural Diversity Database
CSC	California Species of Special Concern
CV	Central Valley
CVCWA	Central Valley Clean Water Association
CVFPP	Central Valley Flood Protection Plan
CVP	Central Valley Project
CV-SALTS	Central Valley Salinity Alternatives for Long-term Sustainability
CVSC	Central Valley Salinity Coalition
CWA	Clean Water Act
CWD	County Water District
DAC	Disadvantaged Communities

Delta	Sacramento-San Joaquin Delta
DMS	Data Management System
DWR	Department of Water Resources
EEMP	Environmental Enhancement Mitigation Program
EFH	Essential Fish Habitat
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EJ	Environmental Justice
EPA	US Environmental Protection Agency
ESA	Federal Endangered Species Act
ESFPP	External Source Flood Protection Plan
EWA	Environmental Water Account
EWMP	Efficient Water Management Practices
F-CO	Forecast-Coordinated Operations
FDA	Food and Drug Administration FDA
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
Flow Criteria	Development of Flow Criteria for the Sacramento-San Joaquin Delta
FOR	Friends of the River
FRAQMD	Feather River Air Quality Management District
FRRFMP	Feather River Regional Flood Management Plan
FRTs	Federally Recognized Tribes
FRWP	Feather River West Project
GAMA	Groundwater Ambient Monitoring and Assessment (California)
GAMT	Groundwater Adaptive Management Tool
GHG	Greenhouse Gases
GIS	Geographic Information Systems
GMP	Groundwater Management Plan
gpcd	gallons per capita per day
HU	Hydro Unit
ILRP	Irrigated Lands Regulatory Program
IRWIS	Integrated Regional Water Information Systems
IRWMP	Integrated Regional Water Management Plan
IVID	Imperial Valley Irrigation District
LEP	Limited English Proficiency
LID	Low-Impact Development
LMA	Levee Maintaining Agency
maf	million acre-feet
MCL	Maximum Contaminant Levels
MHI	Median Household Income
MJMHP	Multi-Jurisdictional Multi-Hazard Mitigation Plan
MLC	Marysville Levee Commission
MOU	Memorandum of Understanding
msl	mean sea level
MSR	Municipal Service Review
NCWA	Northern California Water Alliance
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program

NFRTS	Non-federally Recognized Tribes
NGO	Non-governmental Organization
NGVD	National Geodetic Vertical Datum
NID	Nevada Irrigation District
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRWA	National Rural Water Association
NWIS	National Water Information System
NYWD	North Yuba Water District
O&M	Operations and Maintenance
OEHHA	Office of Environmental Health Hazard Assessment
OHV	Off Highway Vehicles
Orders	Conditional waivers of Waste Discharge Requirements
PG&E	Pacific Gas & Electric
PIER	Public Interest Energy Research
Plan	referring to IRWM Plan
PRC	Public Resource Code
PUD	Public Utilities District
RCBs	Rural Community Boundaries
RCD	Resource Conservation District
RCP	Regional Conservation Plan
RD	Reclamation District
RDS	Robust Decision Support
Reclamation	US Bureau of Reclamation
RFMP	Regional Flood Management Plan
RMSs	Resource Management Strategies
RMT	River Management Team
RTCA	Rivers, Trails, and Conservation Assistance
RWMG	Regional Water Management Group
RWMP	Regional Water Management Plan
SBFCA	Sutter Butte Flood Control Agency
SCP	Strategic Conservation Plan
SEI	Stockholm Environmental Institute
SNMP	Salt and Nutrient Management Plan
SPFC	State Plan of Flood Control
SRF	State Revolving Fund
SRHR	Sacramento River Hydrologic Region
SSID	South Sutter Irrigation District
SWAMP	Surface Ambient Water Monitoring Program
SWMP	Storm Water Management Plan
SWP	State Water Project
SWRCB	State Water Resources Control Board
SYRCL	South Yuba River Citizens League
TBI	The Bay Institute
TDS	Total Dissolved Solids

TMDL	Total Maximum Daily Loads
TNF	Tahoe National Forest
TPL	Trust for Public Land
TRLIA	Three Rivers Levee Improvement Authority
TU	Trout Unlimited
USACE	US Army Corps of Engineers
USDA	US Department of Agriculture
USFS	US Forest Service
USFWS	US Fish & Wildlife Service
USGS	US Geological Survey
UWMP	Urban Water Management Plan
VOCs	Volatile Organic Compounds
WDL	Water Data Library (DWR)
WDRs	Waste Discharge Requirements
WEAP	Water Evaluation and Planning
WMI	Watershed Management Initiative
WPIC	Western Pacific Interceptor Canal
WSA	Water Supply Assessment
YCWA	Yuba County Water Agency
YRDP	Yuba River Development Project
Yuba Accord	Lower Yuba River Accord

Chapter 1.0 Executive Summary

Placeholder - Not required for DWR Compliance

Chapter 2 *Plan Development Process*

2.0 Introduction

This chapter describes the process by which the 2015 Yuba County Integrated Regional Water Management Plan (Plan) was updated, beginning in April 2013 and extending through June 2015.

The IRWMP update process involved a wide variety of participants, workshops, meetings, group structures, and project development forums, discussed below. Important aspects of the update development included: formation of the Regional Water Management Group (RWMG); development of a governance structure and process; extensive "circuit-riding" activities to increase stakeholder participation; Tribal, Latino, and Hmong outreach; public meetings; project development activities; a climate change core group; and coordination with adjacent IRWM regions.

While many aspects of the Plan update process were sequential – and dependent on previous steps – most were coincidental, occurring in a parallel timeframe with one another. For instance, circuit-riding strategies to increase stakeholder involvement in the IRWMP process were conducted while the governance structure was being developed. And once project development processes were formulated and approved, project development proceeded alongside other aspects of Plan formulation. So, while each aspect of the process is discussed below, each was integrated appropriately with other Plan aspects.

2.1 Regional Water Management Group

The RWMG was formed early in the update sequence. Its structure and membership was based upon and expanded from the original management group (MG) that oversaw the development of the 2008 IRWMP. The RWMG served as the lead entity during Plan update and approved all Plan content. The RWMG is the entity that will adopt the Plan, and whose future membership will depend on each individual agency and organization adopting the Plan. Throughout Plan preparation, the RWMG played a critical role by providing direction on chapter content and review, public and stakeholder outreach and involvement, project development and integration, and ensuring consistency of the Plan with Department of Water Resources (DWR) guidelines. This Plan was subsequently reviewed by DWR for guideline compliance. The ongoing governance of the group, described below, will remain the responsibility of the RWMG.

The RWMG mailing list includes 46 entities (see Chapter 3 *Stakeholder Involvement*). A near majority of these entities are active members, participating in meetings, content review, coordination between stakeholders, and communications. The next largest segment of participants responds to requests for information and generally attends only meetings of interest. The remaining groups have requested to be kept informed of RWMG activities. Involved entities represent a full cross-section of water and land management agencies and groups (federal, state, local, and land trusts), non-governmental organizations (primarily environmentally oriented), and Disadvantaged Communities.

The RWMG met 10 times during the course of the Plan update process. The RWMG recruitment process and membership are more fully described in Chapter 3 *Stakeholder Involvement* and Chapter 16 *Governance.*

2.2 Development of a Governance Structure

At the first RWMG meeting in June 2013, the RWMG made an initial determination that: the group would reach decisions by consensus, a formal Memorandum of Understanding (MOU) would be developed that would require Plan adoption by individual entities, no additional governance structures would be required to either manage Plan updates or Plan implementation, and that the group would meet as required during the IRWMP update process and then at least twice annually after IRWMP adoption. The governance discussion extended over several meetings and included a presentation of a variety of governance options developed by other IRWM regions, to ensure that the group had access to the full range of thinking within the current IRWM community.

Please see Chapter 16 *Governance* for a full description of both the process and decisions made as a result of RWMG deliberations on the short- and long-term governance structure for the group. Also refer to **Appendix 17-1** Memorandum of Understanding, for the full text of the MOU document.

2.3 Circuit-Riding Activities

In the months prior to the first RWMG meeting, the project team conducted extensive outreach across the region to determine how best to invigorate participation in the process. The outreach included email contacts, phone calls, and meetings, and took place between May and October 2013.

Key outcomes of the circuit-riding process were: a determination to limit the number of RWMG meetings, use of ongoing circuit riding to keep less active members informed of the process and outcomes, implementation of targeted technical assistance activities to support project development, and identification of the participation status of each entity.

A total of 76 entities were contacted: 40 agencies, districts, and municipalities; 13 non-governmental organizations; 16 Tribal entities; 4 Latino groups; and 3 Hmong organizations. The reasons most frequently given for non-participation were: lack of available staff, limited funding to support staff participation, and the belief that the active participants would adequately represent the perspective of their entity.

Chapter 3 *Stakeholder Involvement* provides a more extensive dissertation of the entities contacted, the process used, and the outcomes of the circuit-riding strategy.

2.4 Tribal Outreach

Tribal outreach was coordinated using the contact list developed for the Yuba County Water Agency (YCWA), Federal Energy Regulatory Commission (FERC) relicensing process. Two formal letters were distributed to the contact list entities: one announcing the preparation of the Plan and convening a meeting with Tribal members in October 2013, and the second announcing the publication of the review draft of the IRWMP document and soliciting comments from Tribal members and entities.
Chapter 5 *Disadvantaged Communities, Environmental Justice and Native American Tribal Considerations* contains greater detail on these outreach efforts. **Appendix 5-1** Letters Soliciting Tribal Participation contains the text of the two letters as well as the distribution list.

2.5 Latino Outreach

This outreach was focused on creating durable connections with the Latino Community within the Yuba region. The effort included in-depth, one-on-one interviews with local leaders and members of community groups, as well as numerous "man on the street" style interviews in Olivehurst, Linda, and Marysville (the communities with the largest Latino population in the region). This outreach resulted in the identification of several overarching issues of concern to the Latino community (i.e., water quality, recreational use, and environmental/climate change concerns), as well as the creation of opportunities for direct connections between RWMG members and members of the Latino organizations. As a result of these interactions, a set of recommendations was developed to guide future interactions. These recommendations were integrated into the IRWMP by the RWMG.

Chapter 5 *Disadvantaged Communities, Environmental Justice, and Native American Tribal Considerations* contains greater detail on these outreach efforts. **Appendix 2-1** Latino Outreach Materials includes the full description of the initial findings and the resulting recommendations.

2.6 Project Development Activities

This aspect of the Plan update process was considered to be of particular importance because water-related projects are a key aspect of IRWMP implementation. Project development for the Plan update took three forms: 1) extensive circuit riding across the region to provide direct, onsite assistance in both identifying specific projects and developing the information to complete Project Solicitation Forms (used to propose projects for inclusion in the Plan); 2) RWMG meetings oriented specifically toward project review, comment, revision, and integration; and 3) a technical assistance workshop for any stakeholders in the region who wanted additional support for project development.

Additionally, the project team gave individual guidance and technical assistance to project sponsors for project finance, greenhouse gas calculations, and climate change considerations to be included on the Solicitation Forms. Project development efforts resulted in the identification of over 60 projects.

2.7 Climate Change Analyses

An advisory Core Group was formed by Stockholm Environmental Institute (SEI) in June 2013, made up of individuals from the main interest groups involved in the RWMG. The Core Group subsequently agreed to act as a technical advisory committee for the IRWMP climate analyses, and included a cross-section of regional interests (see Chapter 11 *Climate Change*).

The initial stages of the climate analyses involved data gathering that led to: 1) a draft synthesis of potential climate trends and impacts, vulnerabilities, adaptation strategies; and 2) a refinement of the framework of inquiry for future Water Evaluation and Planning (WEAP) hydrologic modeling from the Core Group's informed participation.

Draft narratives and background materials of climate vulnerabilities were prepared for review, and a vulnerability checklist based on the DWR's Climate Handbook (see **Appendix 11-1**) was populated with information from the data collection effort and then presented to and refined by stakeholders.

Meanwhile, the SEI team continued to engage the Core Group in meetings to consider and refine influences on its hydrologic modeling, including climate.

In March 2014, the Core Group met to consider and amend the posted climate materials and to prioritize regional climate vulnerabilities under a directed exercise by the project ream that evaluated both the severity of the risk and likelihood of occurrence of vulnerabilities. The recommended prioritization was forwarded to the RWMG and was incorporated into the climate chapter.

Because the timeframe for SEI's modeling was to extend beyond the preparation period for this Plan, and because that modeling had the potential to define new, as well as refine draft adaptation strategies, the Core Group made the decision not to prioritize specific adaptation strategies at this time.

Where projects were sufficiently developed, the project team conducted greenhouse gas (GHG) emission calculations. These calculations are included in **Appendix 14-4**. A summarized list of climate vulnerabilities also was briefly discussed with potential project sponsors when the project team conducted project recruitment. This served as a means of incorporating climate mitigations into implementation projects.

2.8 Coordination with Adjacent IRWM Regions

The coordination between the Yuba County IRWM region and its adjacent neighboring regions was conducted using interviews between RWMG members and the staff or representatives of the adjacent areas. Adjacent IRWM regions are: Upper Feather River Watershed, Cosumnes American Bear Yuba (CABY), American River Basin, and North Sacramento Valley Group. Each region was contacted by phone and interviewed with a focus on opportunities for joint project development, overlapping issues between and among the regions, and potential conflicts in goals/objectives and/or projects between regions.

The results of these interviews are discussed in Chapter 4 *Coordination* and **Appendix 4-1** Inter-IRWM Coordination Reports.

Chapter 3 *Stakeholder Involvement*

3.0 Introduction

Successful implementation of the Yuba County Integrated Regional Water Management Plan (IRWMP) depends on the participation and commitment of the region's stakeholders. Diverse stakeholder membership is essential to producing integrated projects that address the issues and needs of the region. A primary component of effective stakeholder involvement is to identify and invite not only those organizations that are most likely to participate and are the easiest to reach, but to extend the outreach efforts to a wide variety of interest groups, disadvantaged and under-represented communities, and other regional stakeholders.

This chapter describes how stakeholders were recruited and involved in both the Plan development and creation of the governance structure, as well the specific steps taken to engage stakeholders in the IRWMP Update. It also describes the processes that the Yuba County Regional Water Management Group (RWMG) currently employs to ensure ongoing and active participation in the IRWMP decision-making process by a variety of stakeholders, including all those who may be affected by the Plan. The chapter describes the methods and strategies that will be used by the group to continue the development of an integrated and adaptive planning effort focused on finding solutions that support the identified objectives for the region.

3.1 Overview

The primary objectives for stakeholder outreach as part of this update effort include:

1. achieve consistent participation from diverse stakeholders, with emphasis on recruiting stakeholders that did not participate actively in the 2008 IRWMP cycle;
2. develop a durable and sustainable level of participation to support governance and ongoing Plan implementation; and
3. involve stakeholders that represent a cross-section of the community.

A key focus of the update effort was the recruitment of a more diverse stakeholder group to integrate into the existing RWMG. A parallel effort was focused on involving agencies and stakeholders that had participated in the initial Plan development, but whose involvement had lessened over time.

The list of RWMG members from the initial effort served as the starting point for developing a recruitment list. The initial recruitment list included 21 agencies, groups, and entities. An outreach system of phone calls, emails, and one-on-one visits (which came to be called circuit riding) was initiated. By June of 2013, a total of 81 stakeholders had been identified and contacted. These groups or entities included 41 agencies, jurisdictions, or departments; 13 non-governmental organizations; 19 Tribal entities; 4 Hispanic community groups; and 3 Hmong community groups. See **Table 3-1** for a complete list of contacted entities.

Table 3-1. Entities Contacted and Recruited for Participation in the RWMG in 2013	
Districts, Agencies, and Municipalities	
Beale Air Force Base Brophy Water District Browns Valley Irrigation District Butte County Water and Resource Conservation California Department of Fish and Wildlife California Water Service Camp Far West Irrigation District Camptonville Community Partnership, Inc. Camptonville Community Services District City of Marysville City of Wheatland Cordua Irrigation District District 10 Landowners - C/O Don Schrader Dry Creek Mutual Water Company GEI Consultants Hallwood Irrigation Company Linda County Water District Marysville Levee Commission National Marine Fisheries Service National Oceanic and Atmospheric Administration	North Yuba Water District Olivehurst Public Utility District Plumas Mutual Water District Ramirez Water District Reclamation District 10 Reclamation District 784 Reclamation District 817 Reclamation District 2103 River Highland Community Services District South Yuba Water District Sutter County Water Resources Division Three Rivers Levee Improvement Authority US Army Corps of Engineers US Forest Service (Plumas and Tahoe National Forests) Wheatland Water District Yuba County Agricultural Commissioner Yuba County Planning Division Yuba County Public Works Yuba County Resource Conservation District Yuba Watershed Protection and Fire Safe Council
Non-profit Organizations	
American Rivers AquAlliance Bear Yuba Land Trust California Sports Fishing Protection Alliance Ducks Unlimited Endangered Species Coalition	Gold Country Flyfishers Foothill Water Network Sierra Nevada Conservancy South Yuba River Citizens League The Sierra Fund Trout Unlimited Trust for Public Land
Tribal Entities	
Colfax-Todd Valley Consolidated Tribe Concow Maidu Tribe of Mooretown Rancheria Enterprise Rancheria of Maidu Indians Estom Yumeka Maidu Tribe Greenville Rancheria Tribe of Maidu Indians Maidu Cultural and Development Group Maidu Nation Maidu/Miwok Mechoopda Indian Tribe of Chico Rancheria	Nevada City Rancheria Pakan-Yani Band of Strawberry Valley Rancheria Shingle Springs Rancheria Susanville Indian Rancheria Tyme Maidu Tribe of Berry Creek Rancheria Tyrone Gorre Tsi Akim Maidu United Auburn Indian Community Washoe Tribe of Nevada and California Nisenan/Maidu
Hispanic Community	
Alliance for Hispanic Advancement Ampla Health	La Cooperative Campesina de California North Valley Hispanic Chamber
Hmong Community	
Hmong American Association Hmong Women's Heritage Association	Hmong Cultural Center of Butte County

Each group that responded to initial calls or emails was interviewed or visited. Follow-up contact was made with groups that did not initially respond.

For this update process, the former Management Group (MG) was renamed as the Regional Water Management Group or RWMG.

Of the groups recruited, 20 began to regularly attend the RWMG meetings, the first of which was held in June 2013. Subsequent meetings were held as follows: October 16, 2013; January 15, 2014; April 16, 2014; May 2, 2014; June 25, 2014; September 24, 2014; October 22, 2014, and scheduled for January 21, 2015.

Early in the stakeholder recruitment process, it became clear that the reduction in regional staff and funding as a result of the 2008 economic downturn, and the length of time separating the two Plan development work efforts had resulted in diminished capacity for many of the groups to attend regular monthly meetings.

As a result, the group agreed that RWMG meetings would be limited to as few meetings as possible, but that the meetings would last longer and have comprehensive agendas to enable focused and intensive work. The RWMG also agreed that recruitment would continue through the October 2013 meeting with a final round of outreach completed by December 2013, at which point the entities that had chosen to participate would become the RWMG. Three exceptions were made in this cutoff of recruitment: Latino, Hmong, and Tribal participation was deemed important, and the process for involvement of these constituencies would continue for the life of Plan preparation and implementation (see Chapter 5 *Disadvantaged Communities, Environmental Justice, and Native American Tribal Considerations*) for a more detailed discussion of this outreach process.

3.2 Stakeholder Composition

Table 3-2, below, identifies the stakeholders participating in the planning effort. Three general levels of involvement have been identified for area stakeholders. Each entity self-identified one of the following levels of participation based on its available funding and staff time or other considerations specific to the individual entity:

1. active participation with intent to adopt Plan Update;
2. participation only in targeted meetings or work groups; or
3. request to remain on the mailing list only.

Table 3-2. Level of Involvement of Yuba County IRWMP Update Stakeholders Recruited in 2013-2015			
Number refers to preferred level of involvement: 1 = Active, 2 = Targeted meetings only, 3 = Mailing list only			
2	American Rivers	1	North Yuba Water District
1	AquAlliance	1	Olivehurst Public Utility District
2	Beale Air Force Base	3	Plumas Mutual Water District
1	Bear Yuba Land Trust	2	Ramirez Water District
3	Brophy Water District	2	Reclamation District 10
1	Browns Valley Irrigation District	1	Reclamation District 784
1	Butte County Water and Resource Conservation District	2	Reclamation District 817
2	California Department of Fish & Wildlife	2	Reclamation District 2103
3	California Sports Fishing Protection Alliance	1	South Yuba River Citizens League
3	California Water Service	2	South Yuba Water District
3	Camp Far West Irrigation District	2	Sutter County Resource Conservation District
1	Camptonville Community Partnership	3	Sutter County Water Resources Division
2	City of Marysville	2	The Sierra Fund
1	City of Wheatland	2	Three Rivers Levee Improvement Authority - TRLIA
1	Cordua Irrigation District	2	Trout Unlimited
3	District 10 Landowners - C/O Don Schrader	3	Trust for Public Land
3	Dry Creek Mutual Water Company	1	Wheatland Water District
2	Ducks Unlimited	3	Yuba County Agricultural Commissioner
2	Foothills Water Network	2	Yuba County Planning Division
3	Gold Country Flyfishers	1	Yuba County Public Works
1	Hallwood Irrigation Company	1	Yuba County Water Agency
1	Linda County Water District	1	Tahoe National Forest
2	Marysville Levee Commission		

3.2.1 2008 Plan Adoptees

A variety of water management agencies, resource conservation districts, reclamation districts, and county and city government agencies adopted the 2008 Plan. **Table 3-3** provides a list of Yuba County 2008 IRWMP adoptees.

Table 3-3. Adoptees of the 2008 Yuba County IRWMP			
Browns Valley Irrigation District	Yuba County Water Agency	North Yuba Water District	City of Wheatland
Olivehurst Public Utilities District	Yuba County Resource Conservation District	California Water Services Company	City of Marysville
Yuba County	Marysville Levee Commission	Linda County Water District	Reclamation District 784

3.3 Process Used to Identify, Recruit Participation of, and Involve Stakeholders

Yuba stakeholders are essential in the process of identifying issues, populating resource management strategies, and developing regional objectives. In recognition of this fact, extensive recruitment was undertaken, as described in section 3.3.1 below, to ensure that the broadest possible spectrum of stakeholders and interested parties were included early enough in the process to ensure their participation in issue, resource management strategy, and objective development. As the Plan is adopted, these stakeholders are also integral to making an IRWMP fulfill its function by incorporating those objectives and resource management strategies into their respective planning efforts and budgets, and by securing funding and implementation of its programs and projects. The following sections describe the steps taken to encourage participation from a wide variety of interest groups.

To best identify and expand participation among under-represented parties, a formal inventory of interested entities was conducted in summer 2013 to determine which groups, agencies, and organizations were currently underrepresented in the RWMG and overall process participation. This inventory revealed there were a variety of non-profit organizations that had not been recruited or participated in the previous effort.

The Yuba County IRWMP Update process then employed a two-phased approach to stakeholder outreach. Phase 1 outreach efforts focused on recruitment of existing and new stakeholders to participate and guide the Update process. Phase 2 efforts focused on project and plan development. The steps taken during each of these phases are described below.

3.3.1 Phase 1 – Recruitment of Stakeholders

The Phase 1 recruitment effort began in March 2013 and extended through December 2013. The first step was to create a contact list which included key stakeholders in the previous 2008 IRWMP. These stakeholders were contacted by telephone. Most stakeholders returned the calls and were asked for their recommendations for additional contacts. If the initial phone call was not returned, the team implemented a three-part contact strategy: three additional phone call attempts, at least two email contacts, and/or a targeted strategy to urge other stakeholders to initiate direct outreach. If this combination of actions did not result in a reply, then no further effort was made to recruit the entity.

As part of all Phase 1 in-person interviews, an effort was made to travel to the stakeholders and interview them onsite at their offices, as part of a purposeful “circuit-riding” strategy, described below in section 3.4. A deliberate effort was made to understand the individual concerns of the stakeholders, to encourage open communication, and to respect their time constraints and investment for this phase of the process. Phase 1 included three rounds of interviews as described below.

Round 1: These interviews occurred in April, May, and early June 2013 before the first RWMG meeting. This effort focused on outreach to previous members and participants identified in the 2008 IRWMP and key stakeholders within each constituency group. Round 1 interviews were conducted with the following organizations:

1. Browns Valley Irrigation District
2. Olivehurst Public Utilities District

3. Yuba County Resource Conservation District
4. Linda County Water District
5. County of Yuba
6. Yuba County Water Agency
7. City of Wheatland

Following is a list of key results and outcomes of these initial meetings:

- Group preference shown for fewer large/group meetings and more one-on-one "circuit riding."
- Significant input/feedback received for overall process design and identification of issues, goals, and objectives.
- Stakeholders used meetings to ask questions aimed at evaluating the overall value of their participation in the IRWMP process.
- In-person meetings allowed individual concerns to be discussed, including sometimes detailed discussions about the day-to-day operations of the stakeholders and their concerns. The information gathered during these discussions supported the ongoing development and refinement of more effective projects with a greater degree of detail.

Round 2: The second round of circuit-riding interviews took place after the first RWMG meeting, from June to December 2013. As part of this effort, the team met again with original members with more in-depth discussions about project development and began outreach to expand participation to potential new stakeholders, including non-water agency entities such as NGOs and non-profit organizations. The project team coordinated, prepared materials, and facilitated 11 meetings with previously participating stakeholders, and eight meetings with newly recruited or previously non-participatory interest groups.

Round 2 interviews were conducted with the following organizations who previously participated in the IRWMP process:

1. Olivehurst Public Utilities District
2. Yuba County RCD
3. County of Yuba
4. Hallwood Irrigation District
5. City of Marysville
6. Reclamation District 784
7. Reclamation District 2103
8. Reclamation District 8
9. South Yuba River Citizens League
10. Three Rivers Levee Improvement Authority
11. North Yuba Water District

Round 2 interviews were also conducted with groups who are not new to the region but who are new to the IRWMP process including:

1. AquAlliance
2. American Rivers
3. Bear Yuba Land Trust
4. Ducks Unlimited
5. Foothills Water Network
6. The Sierra Fund
7. Trout Unlimited
8. Trust for Public Land

Following is a list of key results and outcomes of these meetings:

- Overall, the meetings assisted with managing and clarifying stakeholder expectations.
- Provided opportunities for team leaders to clarify the important differences between obtaining project funding (through future bond-funded implementation grants) and IRWMP participation in Plan development and ongoing monitoring of Plan performance.

- Stakeholders showed strong preference for a concisely written IRWMP and an Executive Summary that could serve as a mini-IRWMP for agency and organizational boards and regional stakeholders.
- In-person meetings resulted in a high rate of participation at RWMG meetings by stakeholders who were interviewed. Eighty percent of meeting participants showed up for two out of three RWMG meetings, thus satisfying the voting criteria as discussed in Chapter 16 *Governance*.
- Most meeting participants ultimately submitted projects.
- As with Round 1, these one-on-one meetings allowed individual concerns to be discussed, including sometimes detailed discussions about the day-to-day operations of the stakeholders and their concerns. This information directly assisted in development of more effective projects with a greater degree of detail.
- As with Round 1, an attribute of some meetings was high degree of candor about issues/ potential conflicts and nuances of long-term relationships between the stakeholders.

Round 3: This round took place in November/December 2013 and involved a final effort to reach out to agencies who did not respond to the first two efforts. This effort was conducted by telephone and email. A small percentage of stakeholders who did not return phone calls or respond to email outreach were kept on the email list but were dropped from active recruitment.

Phase 1 Summary

The recruitment phase ended in December 2013, with the exception of Tribal and Latino outreach (see Chapter 5 *Disadvantaged Communities, Environmental Justice, and Native American Tribal Considerations*). Over time, the contact list has been refined. Groups have responded by participating at one of the following levels: 1) active participation and Plan adoption; 2) requests to remain on the mailing list with varied levels of participation; and 3) participation only in targeted meetings or work groups.

As a result of the stakeholder outreach program implemented between June of 2013 and June of 2014, today there are 15 voting member organizations that consistently participate in the IRWMP Update and, of these, six are non-water agency organizations. It is expected that all of these members will adopt the final IRWMP Update. In addition, the Yuba County RWMG continues to add new member organizations as participants tell others of the perceived benefits of involvement in the group.

3.3.2 Phase 2 – Project and Plan Development Outreach

The Phase 2 outreach consisted of two components: project-related outreach effort and Plan-related outreach effort. This effort focused on members and participants who were likely to include projects in the IRWMP Update and members who participated in project development workshop held in November 2013. This entire phase involved intensive coordination with multiple phone calls and emails to invite as much participation as possible.

The project-related outreach effort began in November 2013 with a Project Workshop and extended through June 2014. Project-related interviews were conducted with the following organizations:

1. Olivehurst Public Utilities District
2. Yuba County RCD
3. County of Yuba
4. Hallwood Irrigation District
5. City of Marysville
6. Reclamation District 784
7. Reclamation District 2103
8. Reclamation District 8

9. South Yuba River Citizens League
10. Three Rivers Levee Improvement Authority
11. North Yuba Water District
12. American Rivers
13. Bear Yuba Land Trust
14. Ducks Unlimited
15. Foothills Water Network
16. The Sierra Fund

Following is a list of key results and outcomes of these meetings:

- The project-related meetings supported project outreach development and design and associated materials.
- These meetings helped facilitate and conceptualize projects that meet local needs and address the specific issues and objectives for the region.
- Overall, these meetings assisted with managing and clarifying project development submittals.
- Provided opportunities for team leaders to clarify project needs and potential integration opportunities.

3.4 Technical and Information Access

The Yuba County IRWMP region is largely economically disadvantaged. While the region supports some public transportation, those communities which do have such systems do not serve any adjacent areas. The terrain in the upper elevations is mountainous and most of the rural areas in this part of the Plan area do not have cable, reliable dish/satellite access, or other methods of systematic Internet access. Taken as a whole, these conditions create special challenges within disadvantaged areas and across the entire Plan area.

The Yuba County Update public outreach process was designed to inform the public and interested parties and to invite a wide spectrum of participants to RWMG meetings. Active participation in the IRWM planning effort requires well-informed stakeholders who understand the reasons for the IRWMP. The Yuba County RWMG promotes public access to its IRWMP activities and processes, regardless of participants' ability to pay, and has tried to overcome barriers to involvement in several ways, as described below.

Yuba County IRWMP website (yubaregion.org): In October 2013, this website was made available to interested parties. The website serves to inform existing members and the public about the IRWMP Update, upcoming meetings, individual member groups, and members' projects. Yuba County IRWMP region members also use the website to share data and funding sources, and to receive input from the public and other members regarding specific projects and proposals.

Telephone and US Postal Service Outreach: Not all stakeholders have equal access to the Internet or electronic means of communication. To overcome this obstacle, the Yuba County RWMG took into account a variety of potential barriers and does not rely solely on Internet access to involve potential participants. In some cases, outreach relied heavily on telephone calls and sending printed copies of materials via the mail.

Recruitment via Spanish Speaker: A Spanish-speaking consultant was retained to coordinate outreach to the Latino community.

Circuit-Riding Strategy: The circuit-riding strategy was developed in response to the limited staffing and travel budgets of stakeholders, as well as an expressed desire to minimize meetings and travel time. Therefore, rather than adopt a "you come to us" strategy, the work effort initially revolved around a "go to them" approach. This approach involved setting meetings with individual or small groups of stakeholders, the consulting team facilitating the meetings and preparing post-meeting notes (distributed via the webpage and email), and convening larger meetings with the "full" RWMG on a quarterly basis. This strategy was so successful that it was also used to develop and refine projects for inclusion in the Plan (see Chapter 14 *Project Application, Development, and Review*).

Scheduled RWMG Meetings: Beginning in June 2013, regular meetings were held which were conducted as public meetings, with the meeting agendas posted on the Yuba County IRWMP website in advance of the meetings. Interested parties and the public were invited to participate in the meetings, which focused on discussion of regional water management issues. The participating agencies also used these meetings to provide comments on development of the Plan.

Public Meetings: On November 21, 2013, and July 23, 2014, the Yuba County IRWMP Update consulting team held public meetings. The meeting notices were posted on the Yuba County IRWMP website and published in the local newspaper prior to the scheduled meeting time. The purpose of these meetings was to inform the public about the planning process and invite participation from interested parties.

3.5 Decision-making Process

Chapter 16 *Governance* presents a full description of the proposed decision-making process and framework for the region.

Simply stated, the decision-making process is as follows:

- All attendees at any meeting may participate in the discussion as presented in the published agenda.
- All meetings will be noticed on the web and by hard-copy/mail (as requested).
- Eligibility to vote on any given issue or topic is limited to entities which have adopted the IRWMP and attended two out of the previous three meetings.
- Each entity will have a single vote.
- All decision meetings will focus on reaching consensus.
- If consensus cannot be reached, then the group will refer the decision to a future meeting.
- At the future meeting, if the group is still unable to reach consensus, then the group may either:
    (a) vote with one vote per entity, and in order to vote must have attended two out of last three meetings. If no consensus can be reached, then a formal vote can be called. A 75 percent super-majority is required for a vote to be considered as binding; or
    (b) refer the issue to a subsequent meeting.
- If no consensus can be reached after several meetings or if the requested vote does not result in a 75 percent super-majority, then the issue can either be referred to a future meeting or be tabled until such time as consensus is reached, or a 75 percent super-majority has been identified.

3.6 Disadvantaged Communities

The importance of addressing issues associated with Disadvantaged Communities in the region is emphasized by the fact that the outreach efforts have been described in a separate chapter. Chapter 5 *Disadvantaged Communities, Environmental Justice, and Native American Tribal Considerations* includes a full description of how the constituencies were identified, the specific activities associated with involving these communities and constituencies, and how the RWMG intends to continue to build relationships and communication.

Chapter 4 *Coordination*

4.0 Introduction

This chapter focuses on both describing the coordination activities that occurred during the Plan Update process and on assuring that this high level of coordination and communication continues into the future. Coordination within the region, with adjacent IRWM regions, and between the Regional Water Management Group (RWMG) and individual entities with federal and state agencies are described in this section. Agency coordination includes consideration of both project development and regulatory compliance.

4.1 Coordination and Communication – Local Agencies and Stakeholders

By June 2013, a total of 81 stakeholders had been identified and contacted. These groups or entities included 41 agencies, jurisdictions, or departments; 12 non-governmental organizations; 18 Tribal entities; 4 Hispanic community groups; and 3 Hmong community groups. Chapter 3 *Stakeholder Involvement* includes a complete list of all entities that were recruited to participate in the Plan Update process, as well as the ultimate level of involvement of each contacted group.

As part of the circuit-riding activities described in Chapter 3 *Stakeholder Involvement*, local issues identified as precipitating project development were identified by all contacted entities. This issues list not only informed the development of the IRWMP issues section, Chapter 12 *Goals, Objectives, Issues, and Conflicts*, but also was provided to all agencies and stakeholders to ensure that the genesis of each project was fully understood from the earliest stages. The project development process described in Chapter 14 *Project Application, Development, and Review* was designed specifically to ensure coordination between local agencies and stakeholders during project development.

Each subsequent round of project development resulted in draft project materials being both posted on the web and emailed directly to the full stakeholder distribution list. Conflicts, linkages, and synergies between individual projects were identified during the review of project materials. If possible, project-related conflicts were identified, then either individual stakeholders collaborated directly to address potential conflicts, or members of the project team were requested to facilitate discussion. As a result of this purposeful and intensive effort, the final set of Plan projects were voted into the Plan unanimously with no dissenting opinions. The project integration process further served to identify potential synergies and efficiencies both within and between identified projects. In several cases project descriptions or components were modified or refined to accommodate discussions and collaboration that resulted from this integration process.

4.2 Adjacent IRWM Coordination and Communication Efforts

4.2.1 Identification of Adjacent IRWM Efforts

Using the official Department of Water Resources (DWR) IRWM funding area and IRWM region area maps, the IRWM regions which share a boundary with Yuba County were identified as American River Basin, North

Sacramento Valley Four County Group, Upper Feather River Watershed, and Cosumnes American Bear Yuba/ CABY. All of these IRWMP regions are within the Sacramento River Funding Area.

4.2.2 Coordination and Communication with Adjacent IRWM Efforts

The RWMG decided to limit coordination with adjacent areas to informal contacts until such time as the group had finalized the issues list, prepared goals and objectives, completed development of the list of projects, and completed the project review based on the criteria "A-L" as stipulated by the guidelines. In this way, the outreach would be based on known factors, and the discussions could be based on concrete findings rather than speculation. Following completion of these initial activities, the RWMG implemented a systematic outreach to adjacent IRWMPs.

At the RWMG meeting in April 2014, stakeholders volunteered to outreach to the adjacent IRWM regions, including CABY, Upper Feather, North Sacramento Valley, and American River Basin (ARB). Scott Matyac of Yuba County Water Agency (YCWA) contacted the North Sacramento Valley Four County Group and ARB; Jim Brobeck of AquAlliance contacted North Sacramento Valley Four County Group; and Rachel Hutchinson of South Yuba River Citizens League (SYRCL) approached CABY, the Upper Feather River Watershed, and the Mokelumne Amador Calaveras. The outcome of these meetings is presented in **Appendix 4-1**.

All of the initial outreach activities were conducted by phone. Ongoing coordination with adjacent IRWM regions will continue using the same contact people with an annual phone call, at minimum, to ensure inter-regional communication.

Additionally, it is important to note that informal coordination has occurred in a variety of ways since the initiation of the Plan Update in early 2013: 1) attendance and conversations at the Sierra Water Work Group conference in Lake Tahoe by RWMG members and project team members (2013 and 2014); 2) attendance and conversations at the Association of California Water Agencies/ACWA conferences, special topic summits and regional forums (Region 2, to which Yuba belongs, as well as immediately adjacent Regions 3 and 4) by RWMG members (2013, 2014); and 3) attendance at DWR-sponsored strategic planning workshops in Sacramento and Redding by RWMG members and project members (April and November 2013).

No interregional conflicts were identified during the outreach conversations or during the many informal meetings between RWMG members and stakeholders in other regions. Instead, the conversations focused on opportunities to collaborate in project development or addressing issues of mutual concern, such as the following:

- equity of funding between IRWM regions within the same funding area;
- discussion of conjunctive use and water banking between regions, as well as issues associated with groundwater management;
- opportunities to coordinate flood control responses and projects;
- watershed management (e.g., forests/fuels/fire, climate change adaptability, riparian and fishery habitat); and
- fisheries (particularly anadromous).

In all cases, the next steps included a set of actions that would support long-term collaboration: attendance at meetings of adjacent RWMGs, formal (via RWMG meetings) and informal (such as opportunistic use of attendance at events) conversations to identify projects that could be multi-IRWM regional (within the Sacramento Region Funding Area), ongoing participation in the Round Table of Regions group, and forwarding

of project lists and updates to adjacent regions to spark discussions about collaborative project design or coordination.

4.3 Coordination with State and/or Federal Agencies

A variety of state and federal agencies were identified as being integral to ongoing IRWM activities. In some cases these agencies maintain regulatory responsibility for potential project implementation. In other cases these agencies have plans or policies which will impact achieving Plan goals and objectives. A list of relevant state and federal agencies follows:

4.3.1 State Water Resources Control Board

Meetings were held in May and August of 2013 with the State Water Resources Control Board (SWRCB) coordinator for the region to identify options for coordination during the Plan update. At the initial meeting the following issues/options were discussed:

1. Central Valley Salinity Alternatives for Long-term Sustainability (CV-SALTS): These are regionally based processes looking at limits to the salts entering Central Valley waterways. If a recycled water project were to go forward through the IRWMP, it would be expected that a Salt and Nutrient Management Plan (SNMP) would be developed in coordination with the CV-SALTS program.
2. Irrigated Lands Regulatory Program (ILRP): The California Rice Coalition does monitoring in compliance with this program; outcomes/data might be integrated into the IRWM process.
3. Total Maximum Daily Loads (TMDLs): There are nine water bodies in the Yuba County IRWMP region on the 2010 list; these should be integrated into the Plan with possible actions identified, or at least the timeline discussed.
4. Dairy Program: There are four dairies in the region; this may be important to discuss depending on the size and relative effects of the dairies.
5. National Pollutant Discharge Elimination System (NPDES) Program: The NPDES Program regulates outflow from wastewater treatment plants, among other sources. Identifying the permits in the region would be helpful in knowing pollutant sources.
6. MS-4 Storm Water Program: This program is part of the NPDES Program, and focuses on topics like minimizing or eliminating discharge in times of high flow. This would include low-impact development (LID).
7. Septic Program: Septic systems can be a problem in concentrated areas or when they are too close to water supply sources/systems (including wells). Nevada County has identified this as an issue, as has the Yuba County Planning Department.

The second meeting in August was a follow-up to the initial outreach meeting on May 3, 2013. The purpose of the meeting was to increase coordination and review the CV-SALTS program in more detail. The Board Executive Officer has given specific direction to staff to ensure that water quality is consistently and persistently referenced throughout IRWM planning; this includes the CV-SALTS program, as well as the TMDL and 303(d) work done by the Board.

The Regional Board contact for the Yuba County Region IRWM process indicated that she would participate regularly to ensure that water quality is a consideration for all applicable issues. In addition, a staffer working with CV-SALTS, including the SNMP for the Central Valley, attended the meeting.

Staff described the CV-SALTS program as a regionally based program that aims to limit the salts entering Central Valley waterways. It was initiated in 2006 as a result of impaired water in the Central Valley. Certain IRWMP projects, namely those entailing recycled water, may be required to have an SNMP, which would be developed in coordination with the CV-SALTS program. Key points from the second meeting are summarized as follows:

- There is currently no SNMP for Yuba County.
- The Central Valley (CV) Salinity Coalition spearheaded the CV-SALTS program to address the issue.
- The Coalition has a tiered strategy and work plan which provides the overall framework with management plans for specific areas.
- All recycled water projects must be approved by letter from the CV-SALTS program.
- The initial conceptual report will include maps that will determine whether Yuba County is a high priority area.

In addition, the following points were discussed and noted for incorporation into the IRWMP Update:

- Kings County, Sonoma, Pajaro, and Mojave IRWMPs addressed CV-SALTS in their IRWMP;
- addition of a table to the Plan that lists the type of regional agricultural uses (if relevant) and the type of SNMP needed should be considered;
- the document library should include SWRCB Resolution No. 5-2010-0024 which requires preparation of an SNMP, and the 2009 State Recycled Water Policy (Resolution No. 2009-0011); and
- the CV Salinity Coalition membership brochure directly addresses the connection to IRWM planning, as follows: "*Groups preparing Integrated Regional Water Management Plans involving Central Valley Waters will be required to manage salinity and document their efforts. The best opportunities to manage salinity exist at the regional scale so coordination is essential. In the Central Valley, coordination with other stakeholders and the Regional Board is best achieved through CVSC. IRWM groups therefore need to join the Coalition. Cities or districts that are planning or implementing a recycled water project or any project that may increase salts or nitrates in the Central Valley need to be a Coalition Member and active participation in CV-SALTS. Irrigated Lands Coalitions operating under Regional Board waivers of waste discharge requirements also need to join the coalition. Any facility that is a WDR or NPDES permit holder that has or could have salinity or nitrogen restrictions in their permit(s) needs to join the Coalition.*"

The results of these meetings were conveyed to the RWMG and ongoing discussions informed both the regional description as well as the issues identification chapter. Ongoing participation in the CV-SALTS effort is included in Plan implementation actions identified in Chapter 17 *Plan Performance and Monitoring*.

4.3.2 US Forest Service

Coordination with the US Forest Service (USFS) was accomplished via staff attendance at the RWMG meetings, USFS staff review of documents, and ongoing meetings between USFS staff and a variety of IRWM members in other venues and on projects on which there is existing collaboration.

4.3.3 Feather River Region – Regional Flood Management Plan

The May 2014 Draft Regional Flood Management Plan states:

> "*The Yuba County Water Agency (YCWA), Three Rivers Levee Improvement Authority (TRLIA), Marysville Levee Commission (MLC), and Sutter Butte Flood Control Agency (SBFCA) have*

partnered with the State of California Department of Water Resources (DWR) to develop this Feather River Regional Flood Management Plan ("RFMP" or "Plan"). This Plan reflects the flood management priorities of the Feather River Region while at the same time aligning with the recently adopted 2012 Central Valley Flood Protection Plan (CVFPP) to the extent feasible. By clearly establishing regional flood management priorities, this Plan will facilitate future funding and implementation of much-needed flood risk reduction projects.

Although funded by DWR, the intent of all five partnering agencies (YCWA, TRLIA, MLC, SBFCA, and DWR) is to facilitate the development of a broadly supported Plan and embrace the FloodSAFE vision….

The regional goals and objectives are to improve flood risk management in the region while advancing the supporting goals of improving operations and maintenance, promoting ecosystem functions, improving institutional support, and promoting multi-objective projects. These objectives of the regional planning process are founded on, and consistent with, the goals of the CVFPP as described in the 2012 Plan."

YCWA served as a liaison with the larger four-agency effort. In addition, TRLIA participated in several of the project development activities to ensure that their projects were afforded consideration and also informed the development of other projects.

4.3.4 Levee Improvement Projects

Yuba County and Reclamation District (RD) 784 work together as the TRLIA to address levee improvement projects on the Feather and Bear Rivers. TRLIA has worked closely for several years with the California Reclamation Board (part of DWR) and the US Army Corps of Engineers (USACE) to address the flood protection needs of RD 784. This work resulted in projects that include the planning, design, and construction of setback levees on the Bear and Feather Rivers.

4.3.5 Forecast-Coordinated Operations of Lake Oroville and New Bullards Bar Reservoir

The Forecast-Coordinated Operations of Lake Oroville and New Bullards Bar Reservoir (F-CO) is a multi-agency regional flood management program to improve flood operations along the Yuba and Feather Rivers and downstream. F-CO is a partnership program that includes the following:

- USACE
- YCWA
- DWR
- National Oceanographic and Atmospheric Administration (NOAA) – National Weather Service-River Forecast Center

F-CO is a multi-year project that includes F-CO Design (Phase 1) and Implementation (Phase 2). Half of Phase 1 is funded with in-kind services from DWR, NOAA, and the Corps, with the remaining half funded by the Costa-Machado Water Act of 2000. Phase 2 (estimated cost of about $1.6 million) is funded with 30 percent provided by YCWA and 70 percent by grant funds. In addition, in-kind services from DWR, NOAA, USACE, and the State Water Project (SWP) will supplement program implementation.

4.3.6 Lower Yuba River Accord

The Lower Yuba River Accord, described in more detail in Chapter 6 *Region Description* was formulated by a broad coalition of 17 agricultural, environmental, and fisheries interests, including state and federal agencies and YCWA.

The Lower Yuba River Accord (Yuba Accord) enables the YCWA to successfully operate the Yuba River Development Project (FERC 2246, 362 MW) for hydropower, irrigation, flood control, recreation, and fisheries benefits. As a settlement agreement, the Yuba Accord is the final product of nearly three years of intense negotiations among 17 stakeholders, including local irrigation districts, state and federal resource agencies, and conservation groups. Based upon the success of two one-year pilot programs (2006/2007), the State of California approved the agreement in 2008, and it is now fully operational. The Yuba Accord is unprecedented in that it combines increased in-stream fisheries flows – for wild, native salmon and steelhead – with increased supplemental water supplies for California cities and farms, while preserving all of the project's clean, renewable hydropower generation capacity. The Yuba Accord also reaffirms the water rights of the YCWA and its member irrigation districts. The Yuba Accord represents a nexus of smart engineering, collaborative partnership, and strategy development in the pursuit of a sustainable solution to a complex controversy.

The Accord stipulates creation of a Resource Management Team (RMT). The RMT is composed of a Planning and Operations group tasked with implementing a detailed monitoring and evaluation study program for the Lower Yuba River as specified in the Lower Yuba River Accord. The RMT membership is limited to signatories of the Yuba Accord, including YCWA, California Department of Fish & Wildlife (CDFW), National Marine Fisheries Service (NMFS), US Fish & Wildlife Service (USFWS), South Yuba River Citizens League (SYRCL), The Bay Institute (TBI), Friends of the River (FOR), Trout Unlimited (TU), Pacific Gas & Electric (PG&E), and DWR.

The IRWMP Update project team attended the 2013 and 2014 Symposiums to inform the agencies present of the status of the Yuba County IRWMP and to ensure coordination between the Lower Yuba River Accord RMT and the Yuba County IRWMP. In addition, several of the RMT members are Yuba County IRWM stakeholders and participated closely on issue identification, development of Plan goals and objectives, and ongoing conversations to inform project development.

Participants and stakeholders in the process include:

- American Rivers
- Bear Yuba Land Trust
- CBEC Consultants
- Foothills Water Network
- Gold Country Flyfishers
- HDR Consultants
- California Department of Fish & Wildlife
- National Marine Fisheries Service
- Pacific Gas and Electric
- Pacific States Marine Fisheries Commission
- South Yuba River Citizens League
- State Water Resources Control Board
- Teichert Aggregates
- The Bay Institute
- Trout Unlimited
- University of California Davis
- US Army Corps of Engineers
- US Forest Service, Tahoe National Forest
- US Fish and Wildlife Service-AFRP
- Yuba County Water Agency

4.3.7 Groundwater Management and Monitoring

YCWA has prepared and adopted an SB 1938-compliant Groundwater Management Plan (GMP). This GMP was prepared by YCWA in cooperation with the local groundwater users and DWR. The agency continues to work and collaborate with DWR staff and with Member Units to implement an enhanced groundwater monitoring program.

Chapter 5 *Disadvantaged Communities, Environmental Justice, and Native American Tribal Considerations*

5.0 Introduction

The 2012 Integrated Regional Water Management (IRWM) Program Guidelines call for consideration of the following specific Disadvantaged Communities (DACs), Environmental Justice (EJ), and Native American Tribal (Tribal) concerns. These include involvement of and collaboration with disadvantaged, Latino and Hmong, and Tribal communities in preparation of the Yuba County IRWM Plan (IRWMP), identification of economic trends and conditions in the watershed that affect these communities, and identification of impacts of Plan implementation that affect disadvantaged, Latino and Hmong, and Tribal communities, with a particular emphasis on issues of environmental justice. These topics are addressed below, and help outline a collaborative process that will engage a balance of interest groups.

Additionally, the guidelines call for consideration of projects that identify and address the water-related needs of the communities; assisting DACs in developing projects (e.g., needs assessments, design, engineering, feasibility studies) and methods to advance such projects; identifying specific benefits to disadvantaged and Tribal communities; and consider redressing inequitable distribution of environmental burdens and access to environmental goods. The project development aspects of disadvantaged, Latino and Hmong, and Tribal issues and communities are discussed in Chapter 14 *Project Application, Development, and Review*.

5.1 Overview of Disadvantaged, Latino and Hmong, and Tribal Community Involvement

At the first Regional Water Management Group (RWMG) meeting in June 2013, the need to involve diverse communities in the planning process was acknowledged by the RWMG members. The RWMG directed the project team to work with individual RWMG members to initiate an outreach effort. The effort was to be focused on systematic recruitment, outreach, and involvement activities, with the expressed intention of not only gaining involvement in Plan preparation, but also ongoing and long-term involvement during Plan implementation.

Central Principles: A number of central principles applied to all of the DAC, Latino and Hmong, and Tribal outreach contemplated under the Yuba County IRWMP update process included:

1. use of a phased approach to outreach that gradually reached greater numbers of people living or participating in targeted communities;
2. recognition of the financial and economic challenges of targeted communities and utilization of a “go to them” approach as much as possible (versus a “come to us” approach);
3. identification of community-specific, water resource-related issues and priorities;
4. working with targeted communities to develop projects or project components that addressed their articulated water-related issues and concerns;
5. working with other project sponsors (e.g., agencies, organizations, groups) who have already developed projects to identify opportunities for collaboration with DACs, Tribes, and EJ communities to augment or refine those projects, if appropriate;

6. conducting one-on-one outreach with individuals or with volunteer boards or, where appropriate, through other social structures such as schools and churches;
7. creation of written materials that serve to both educate communities and support increasing levels of involvement with the IRWM Program; and
8. building a simple database that supports systematic and consistent contacts with community members (e.g., a contacts directory).

Common Strategies: A variety of common strategies applied to all of the outreach contemplated under the Yuba County IRWMP update process, regardless of the targeted community – DAC, Tribal, and/or Latino and Hmong.

These common strategies included:

1. conducting outreach to inform representatives and community members about opportunities and potential benefits presented by the IRWMP process; informing, educating, and recruiting participation through regional meetings, word of mouth, the IRWMP website, and through other materials as needed;
2. encouraging involvement in IRWMP decision-making through invitations to participate in meetings, committees, work groups, and document review;
3. conducting outreach to communities in a manner that clearly identified benefits and opportunities presented by the IRWMP process, and soliciting meaningful feedback to the development of the Plan, development of projects, participation in decision-making, and revisions to the Plan over time;
4. conducting outreach to inform representatives and community members about opportunities and potential benefits presented by the IRWMP process;
5. informing, educating, and recruiting participation through regional meetings, subregional meetings, word of mouth, the IRWMP website, and through other materials as needed;
6. identifying and developing community-specific projects by providing in-kind technical support (e.g., planning, project design, preliminary cost/benefit analysis) to ensure that community issues are addressed wherever possible;
7. for rural communities, placement of IRWMP information, documents, materials, and data in local libraries (or other public equivalent) to facilitate public access and build awareness, understanding, and involvement in the IRWMP process;
8. conducting workshops focused on building capacity for fundraising and other needs as identified through the community outreach;
9. looking to the longer-term horizon of the Plan and working with communities to increase participation in IRWMP decision-making and governance; and
10. working with communities to identify barriers to IRWMP participation (e.g., IRWMP adoption), and to identify possible solutions.

Ongoing RWMG Commitment to DAC/Tribal Outreach and Involvement: The Yuba County IRWMP RWMG is committed to ensuring the ongoing participation of the communities that have worked so hard to be involved in the Plan update process. In support of continuing these efforts, the RWMG has identified the following commitments to implement over time:

1. ongoing outreach to disadvantaged and Tribal communities and entities to ensure that opportunities for involvement are clearly understood, including ongoing outreach by designated RWMG members to identify groups and support ongoing involvement; and

2. sustaining stakeholder involvement by recognizing it during RWMG meetings and according it the same importance as any other input, questions, or requests; and being prepared to hear what stakeholders say and respecting the passion they bring to their participation.

5.2 DAC Involvement

Per the 2012 IRWM Program Guidelines, a DAC is defined as a community with an annual median household income (MHI) less than 80 percent of the statewide annual MHI. Based on the 2010 Census, six communities within the Yuba County IRWMP region are now identified as DACs (MHI is $48,706 or below). The statewide annual MHI in California in 2010 was $57,708.[1] The following text explains how the DACs were identified, recruited, involved, and provided technical support.

5.2.1 DAC Identification

The DAC involvement program began with a determination of the DACs in the Plan area (using both DWR mapping and Census data to ensure all possible participants were identified). The communities in the Yuba County IRWMP region that qualify as DACs are listed below in **Table 5-1**.

Table 5-1. Communities in the Yuba County IRWMP Region Designated as Disadvantaged (less than 80 percent of the California median household income)

County	Census Places	MHI
Yuba	Dobbins (just east of Oregon House)	$42,946
	Camptonville	$27,031
	Beale	$41,917
	Marysville	$34,351
	Olivehurst	$42,565
	Linda	$37,364

These six communities were the core focus of the DAC outreach and involvement effort.

5.2.2 DAC Outreach

Following the determination of the DAC areas, the project team initiated a systematic outreach to DAC representatives and residents. This effort relied heavily on a "go to them" or what became known as a "circuit-riding" strategy.

This stratagem was employed in direct response to a first round of phone contacts with local agencies and organizations. It became clear almost immediately that most of the entities in the region were suffering from limited budget and staff time to support travel and multiple meetings, both as a result of their intrinsically disadvantaged status, as well as the cumulative and ongoing effects of the 2008 economic slowdown. This outreach also focused on identifying critical water needs, as well as identification of instances where

[1] US Census Bureau, *American Fact Finder*, http://factfinder2.census.gov.

availability of water was limited or compromised. Chapter 3 *Stakeholder Involvement* provides an extensive description of this process.

5.2.3 DAC Project Development

The DAC outreach process included a strong focus on project development. Team members attended numerous meetings with DACs, assisted in identification of possible projects and options for project integration, and assisted directly in the development of the Project Solicitation Forms (**Appendix 14-1**) which were required of each project prior to its inclusion in the IRWMP. Technical support, ranging from phone conversations to project development workshops to one-on-one meetings, was given as required or requested.

As part of the project development process for DACs, not only were individual DACs contacted and provided with technical support for project development, but the DWR "A-L Review Criteria" relating to critical water supply concerns were also integrated into the outreach and project development program.

5.3 Environmental Justice Outreach

To address issues of environmental justice, outreach focused on two primary constituencies: Latino/Hispanic and Hmong communities.

The Latino population in the Plan area is relatively high (comprising 25 percent of the area population, with some communities made up of larger percentages of Latino constituencies, such as Olivehurst, which is comprised of 36.6 percent Latino residents). The Hmong community comprises roughly four percent of the Plan area population. Outreach to these two communities was focused primarily on local groups and leaders, as well as local "person-on-the-street" interviews.

The population in Yuba County is becoming increasingly diverse, with minority communities rapidly growing throughout the area. Hispanics (or Latinos, as some prefer) currently make up 25 percent of the county's population, an increase from 17.4 percent during the previous census. All trends point to this number continuing to grow throughout the foreseeable future.

Many minority communities generally do not engage in planning processes such as the IRWMP, due in part to linguistic, cultural, and historic barriers. Spanish-speaking residents comprise 17.18 percent of Yuba County's population. Asian or Pacific Islander languages, primarily Hmong, are spoken among 4.42 percent of the community. With more than one-fifth of the county's population potentially having Limited English Proficiency (LEP), concerted efforts are necessary to effectively engage these populations in planning processes.

The Latino population is as diverse in its origins as the Anglo population, representing multiple countries of various continents around the world. Some Latinos are native English speakers and some have a rudimentary or nonexistent fluency in English. The same holds true with Hmong populations. White Hmong and Green Hmong differ culturally and linguistically and, as with Spanish speakers, levels of English proficiency vary significantly, particularly amongst different Hmong generations.

The Yuba County IRWMP's outreach efforts focused on this latter group of LEP community members, those who are mono-linguistic or linguistically isolated (where all adults in a household speak a language other than English and none speaks English proficiently) and, therefore, require assistance to understand or benefit from

government or social services. Outreach efforts to such communities are further hampered by a cultural distrust of government, and of quasi-governmental agencies or efforts, which is how a state-funded IRWMP effort would likely be perceived, and a need to focus on day-to-day life challenges, such as work, family, and financial obligations.

5.3.1 Latino/Hispanic Outreach

Due in part to language and perception-based isolation, the Latino community is not engaged in water planning processes, and the information and engagement opportunities being generated by these processes are not effectively reaching this audience. It is therefore a high priority for any comprehensive water planning to proactively engage this community.

To better understand the water needs of the Latino community in Yuba County, members of the Alliance for Hispanic Advancement were contacted via one-on-one, in-depth interviews. Person-on-the-street interviews were also conducted with 17 Latino residents in Olivehurst, Linda, and Marysville, which are the three communities in Yuba County with the largest Latino populations: 36.6 percent, 32.5 percent, and 24.2 percent respectively.

Below are some of the main findings from this Latino-focused outreach:

Water Quality

- The Latino community is overwhelmingly unaware of water issues, the watershed, or where its water comes from.
- None of the person-on-the-street interviewees could confidently identify his or her water purveyor. The vast majority didn't know, and a few tentatively answered that the city provided their water. Most of the interviewees live in apartment complexes, so utilities may be included in their rent, thus eliminating direct interaction with their water purveyor.
- None of the individuals interviewed trust the quality of the water that comes into their homes. Several people reported a foul smell in their water, identifying it as perhaps chlorine or another chemical. One of the in-depth interviewees claimed that the smell was caused by sewer water being recycled and used as potable water. There is clearly a dearth of community trust in relationship to water quality.
- Because community members mistrust the quality of the water, many instead purchase bottled water. Every person-on-the-street interviewee volunteered that they purchase bottled water rather than drink the water that comes out of their faucets, even as some lamented the high cost of doing so. One in-depth interviewee estimated that about 80 percent of the Latino community in Yuba County purchases bottled water.
- On the basis of the outreach, it appears that changing perceptions about the quality of local water will be a difficult proposition. When asked whether information showing the quality of their water would improve trust and confidence in the water, responses were evenly split. About half of the respondents said information would help them trust the water. Close to the same number of people stated that it would not affect their perceptions and that they would continue purchasing bottled water.

Recreational Use

- Recreational use of water was touched upon briefly in the interviews. It was noted that Latinos have not typically used the rivers in the area for recreational purposes, but that community members are beginning to do so more and more. As this trend continues, the county may need to prepare for higher utilization of these resources. Issues of consumption of local fish with associated health risks

may also arise as a result of this increased use. Lastly, signage for local recreation areas in Spanish (or using the universal symbols) should be considered.

Environmental/Climate Change

- In-depth interview respondents stressed that the community needs education about how their actions affect water quality.
- Most person-on-the-street interviewees were unaware of whether or not they lived in a designated floodplain. One respondent said he believed that he did, because he had heard that years ago snowmelt flooded the area where he lives.
- None of the person-on-the-street respondents were aware of any city- or county-led efforts or plans to alleviate the impacts of heat waves. Respondents were not aware of any cooling centers or places they could go to in order to escape the effects of the heat.

While the number of interview participants is not large enough to constitute a statistically significant sample whose findings may be applied across Yuba County's Latino population, it does provide meaningful information that can be used as the foundation for future outreach and engagement efforts.

Recommended Actions

Several short-term and long-term next steps can be taken to further learn the needs of the Latino community and better engage this important stakeholder group. The RWMG has approved the recommended actions.

Short-Term Activities

Recommendation	Description
1 Presentations to Latino community-based organizations	During the initial outreach, one of the organizations that was identified and engaged was the Alliance for Hispanic Advancement (AHA). Further engagement of this organization and other similar ones would be beneficial. Yuba RWMG representatives should attend one of AHA's scheduled meetings and present on water issues and specific projects that are being considered, especially those of potential significance to the Latino community. Input from AHA would be helpful in better understanding the priorities of this community and identifying additional issues or projects not currently being considered. Working with AHA to identify the top three water-related issues, for instance, would serve to narrow the focus of subsequent outreach. It would also further strengthen the link between both organizations, potentially forging stronger involvement from Latino leaders in water issues and therefore finding more effective ways to leverage the education opportunities by coordinating with leadership outreach.
2 Additional person-on-the-street interviews	During the initial outreach phase, it was identified that the Latino community needs more education about the impact their actions have on the environment. Additional person-on-the-street interviews should focus specifically on identifying areas where environmental education would be beneficial and on finding out which individuals or organizations the locals would trust as purveyors of the information. From experience in other regions, we could make an educated guess that some of these issues may be related to improper disposal of motor oil and cooking fats, oils, and grease; proper cleanup and stewardship of rivers, lakes, and other waterways; and the negative environmental impact of the large number of water bottles used by stakeholders. These are guesses, albeit based on experience in other Latino communities. However, it is imperative that we reach out to the community to clearly identify these topics, rather than assuming that they are the same from community to community. This information would help identify education needs and develop education models to enhance the community's awareness of the impact their actions have on the watershed.
3 Develop bottled water and drought brochures	Create and distribute a brochure, in Spanish, educating consumers about the quality and cost of tap water versus bottled water and the benefits of changing their current reliance on bottled water, as well as the environmental consequences of using bottled water. Copy for a similar brochure has already been developed for another water

region, so it would only require minor revisions (e.g., quotes by local leaders, pictures and diagrams that are locally relevant) to localize the materials for the Yuba County community. Sponsorship of the brochure by organizations such as AHA and promotion in local Spanish-language media should be considered to ensure that the source of the information is trusted by the larger community. Another option would be to create a bilingual flyer with the same information and distribute it as a bill insert to all water agency customers. Further, education on the impacts of drought could also be included in this brochure or in a separate publication. Strategies will need to be developed to ensure that renters also receive these brochures.

Long-Term Activities

Recommendation	Description
1 Work with existing water groups to incorporate focus on Latino issues	Identify stakeholders or organizations within Yuba County who are already working on water education and outreach efforts and collaborate with them to implement efforts specifically targeting Latino communities. Existing or proposed water projects could also be identified that would benefit from incorporating Latino outreach and education elements.
2 Develop Spanish-language water-quality education effort	The Yuba County RWMG could take steps to help educate the Latino community about the quality and safety of their water, and try to help curtail the high use of bottled water. A targeted campaign designed to reduce use of bottled water could include development of educational materials (for use in schools, as well as with adults), such as flyers, brochures, public service announcements (radio and television) and more, as well as public relations efforts, such as engaging Spanish media and development of Spanish news releases to increase coverage of the issue.
3 Outreach to Latino leaders and key community members	Engage additional Latino leaders and key community members to have an ongoing feedback loop into the Latino community. By doing so, the Yuba County RWMG can stay atop the changing needs of the Latino community and adapt as those needs change. Furthermore, engaging Latino leaders and other community members enhances the opportunity to have that community represented at the table as decisions on water issues and water planning are being made.

Additional efforts on this issue are needed. Whether it is one of the suggestions listed above, a comprehensive combination of some or all of the suggestions, or different ideas altogether, the Latino community is substantial in number and growing fast, and needs to be effectively engaged. Any water projects or issues must include the Latino community for them to be successful and relevant. As time passes, this issue becomes more critical and harder to accomplish.

This document and the efforts that led to its development are the first step in this process. Additional work is needed and the Yuba County RWMG is in a position to make it happen.

5.4 Native American Tribal Involvement

DWR uses the term "California Native American Tribe" to signify all Indigenous Communities of California, including those that are Non-federally Recognized and Federally Recognized, and those with allotment lands, regardless of whether they own those lands. Additionally, some water bodies and Tribal boundaries may cross regional boundaries. Therefore, IRWMP outreach efforts should include all Tribes that are impacted by water in an Yuba County IRWMP region. Further, DWR recognizes that there are challenges to some types of Tribal participation in the IRWMP process (e.g., need to adopt the Plan in order to be a project sponsor), and continues to work with Tribes to address these challenges at the state level (DWR Tribal Communication Plan Draft, Summer 2008).

The Yuba County IRWMP region includes both Federally Recognized Tribes (FRT) and Non-Federally Recognized Tribes (NFRT). FRTs have sovereign powers, a unique political status that requires government-to-government relationships. For outreach purposes, it is important to note that FRTs generally have paid staff and clear points of entry for communication efforts (e.g., Environmental Director, Tribal Council), whereas NFRTs often do not. Further, individual NFRT members may themselves be geographically dispersed, making outreach more difficult.

Because the Yuba County IRWMP's prior outreach efforts did not result in the desired high level of Tribal participation, a different outreach strategy has been employed.

HDR, Inc., who is coordinating the FERC Tribal outreach for Yuba County Water Agency's (YCWA) FERC relicensing effort, was identified as the appropriate consultant to assist with IRWMP Tribal outreach. The initial outreach strategy included identification of Tribal entities with interests in the Plan area, drafting a letter for YCWA signature inviting identified Tribal contacts to a meeting to discuss IRWM and project development, conducting the scheduled meeting using facilitators familiar with Tribal process, following up on meeting action items, and identifying additional opportunities for a subsequent Tribal meeting. **Appendix 5-1** includes a copy of the letter soliciting participation in the September 2013 meeting, materials distributed at that meeting, a list of attendees and a copy of a second letter distributed in August 2014 requesting Tribal review of the draft Yuba County IRWMP document. **Appendix 5-2** includes copies of agendas and meeting notes from Tribal Outreach.

Based on the outcome of the two Tribal outreach activities, the following ongoing involvement strategies will be pursued:

- Outreach to include Tribal concerns in the IRWM process will continue.
- This outreach will be developed and refined based on ongoing communications with Tribal entities.
- The RWMG remains committed to engaging Tribal members in the IRWMP process.

Table 5-2. Latino, Hmong, and Native American Tribal Communities Contacted During Preparation of the Yuba County IRWMP Update	
Tribal Entities	
Nevada City Rancheria Washoe Tribe of Nevada and California Tsi Akim Maidu United Auburn Indian Community Concow Maidu Tribe of Mooretown Rancheria Greenville Rancheria Tribe of Maidu Indians Mechoopda Indian Tribe of Chico Rancheria Shingle Springs Rancheria Tyme Maidu Tribe of Berry Creek Rancheria	Pakan-Yani Band of Strawberry Valley Rancheria Maidu/Miwok Nisenan/Maidu Enterprise Rancheria of Maidu Indians Maidu Nation Tyrone Gorre Maidu Cultural and Development Group Colfax-Todd Valley Consolidated Tribe Susanville Indian Rancheria
Hispanic Community	
Alliance for Hispanic Advancement La Cooperative Campesina de California	North Valley Hispanic Chamber Ampla Health
Hmong Community	
Hmong American Association Hmong Women's Heritage Association	Hmong Cultural Center of Butte County

Chapter 6 *Region Description*

6.0 Introduction

The Yuba County IRWMP region is situated within California's north Central Valley, and incorporates all of Yuba County and the lower reaches of the Yuba River watershed (see **Figure 6-1**). The region extends from about the 4,850-foot elevation in the foothills of the Sierra Nevada to the Sacramento Valley floor, where the Yuba River flows into the Feather River near Marysville. Yuba County encompasses 412,160 acres, or 644 square miles, making the Plan area one of the smallest IRWM planning regions in the state.

The Plan area can be divided into two distinct zones: the lower watershed (i.e., valley floor) and upper watershed (i.e., foothill and mountain areas), as described further in the following sections. While these distinct zones have some differing water management issues, they are linked by shared use of resources, including surface water of the Yuba, Feather, and Bear Rivers and their tributaries. Additionally, the Yuba River watershed comprises five primary reaches: the North Fork, Middle Fork, South Fork, Main Stem and Lower. The Plan area includes portions of the North Fork, and all of the Main Stem and Lower river reaches (see **Figure 6-2**).

6.1 Valley, Foothill, and Mountain Areas

Within the Plan area, the valley floor is bisected by the Yuba River, and the surrounding terrain is primarily flat, with rural farmlands and urbanization, both subject to flooding during storm events. The valley area incorporates the entire lower section of the Yuba River watershed and small portions of the Feather and Bear River watersheds. As is typical of the Sacramento and Central Valleys, developed areas in the valley floor are highly dependent on levees for flood protection, and they can experience difficulties with drainage and wastewater discharge. The rural sections of the valley area are also challenged by agricultural water supply reliability and the conversion of agricultural lands to residential areas. The Yuba County valley floor shares boundaries with the county's two groundwater subbasins, known as North Yuba and South Yuba, described further below.

The foothill and mountain areas are located immediately east of the valley floor. The terrain consists of natural vegetation and rolling foothills subject to frequent fires. The higher elevations of Yuba County incorporate sections of the North, Middle, and South Yuba River watersheds and a portion of the Feather River watershed. Most developed areas in the foothills rely primarily on surface water, while most rural residential users rely on groundwater. Water supply reliability is the primary water management issue for these areas because of the limited groundwater availability and limited access to surface water resources.

Figure 6-1

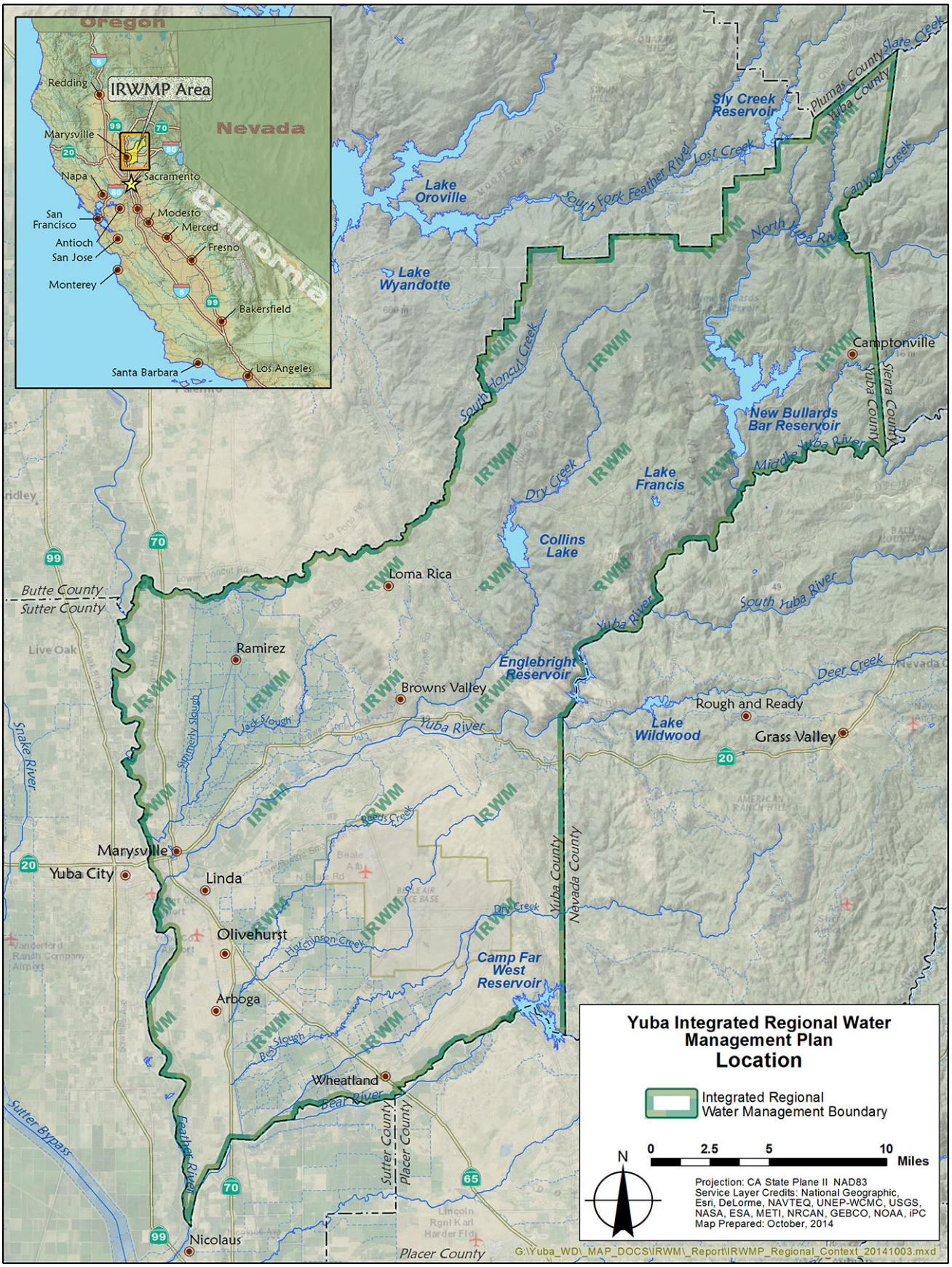
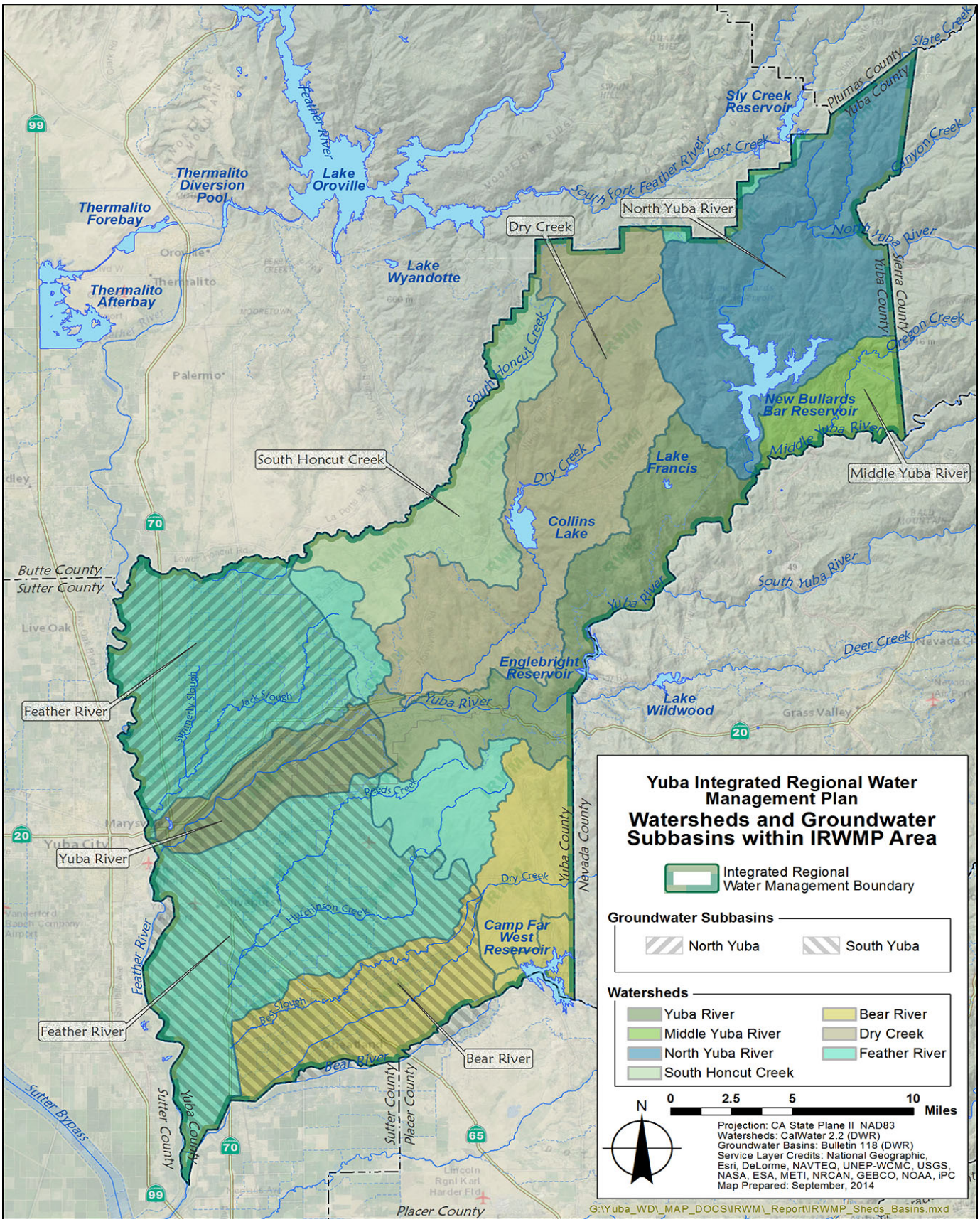

Yuba Integrated Regional Water Management Plan
Location
Integrated Regional Water Management Boundary
0 2.5 5 10 Miles
N
Projection: CA State Plane II NAD83
Service Layer Credits: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC
Map Prepared: October, 2014
G:\Yuba_WD_MAP_DOCS\IRWM_Report\IRWMP_Regional_Context_20141003.mxd
IRWMP Area
Oregon
Nevada
California
Redding
Marysville
Napa
Sacramento
San Francisco
Modesto
Merced
Antioch
San Jose
Fresno
Monterey
Bakersfield
Santa Barbara
Los Angeles
Lake Oroville
Lake Wyandotte
Sly Creek Reservoir
Plumas County
Yuba County
Slate Creek
Lost Creek
South Fork Feather River
Canyon Creek
North Fork Yuba River
Camptonville
Sierra County
New Bullards Bar Reservoir
Middle Yuba River
South Honcut Creek
Dry Creek
Lake Francis
Collins Lake
Loma Rica
Butte County
Sutter County
Live Oak
Ramirez
Browns Valley
Englebright Reservoir
South Yuba River
Deer Creek
Rough and Ready
Lake Wildwood
Grass Valley
Yuba River
Jack Slough
Snake River
Simmerly Slough
Reeds Creek
Marysville
Yuba City
Linda
Olivehurst
Hutchinson Creek
Camp Far West Reservoir
Arboga
Bear Slough
Wheatland
Bear River
Sutter Bypass
Feather River
Nicolaus
Placer County
Nevada County

Figure 6-2


Yuba Integrated Regional Water Management Plan
Watersheds and Groundwater Subbasins within IRWMP Area
Integrated Regional Water Management Boundary
Groundwater Subbasins
North Yuba
South Yuba
Watersheds
Yuba River
Middle Yuba River
North Yuba River
South Honcut Creek
Bear River
Dry Creek
Feather River
0 2.5 5 10 Miles
N
Projection: CA State Plane II NAD83
Watersheds: CalWater 2.2 (DWR)
Groundwater Basins: Bulletin 118 (DWR)
Service Layer Credits: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC
Map Prepared: September, 2014
G:\Yuba_WD_MAP_DOCS\IRWM_Report\IRWMP_Sheds_Basins.mxd
Lake Oroville
Thermalito Diversion Pool
Thermalito Forebay
Thermalito Afterbay
Lake Wyandotte
Sly Creek Reservoir
New Bullards Bar Reservoir
Lake Francis
Collins Lake
Englebright Reservoir
Lake Wildwood
Camp Far West Reservoir
Plumas County
Yuba County
Sierra County
Nevada County
Sutter County
Placer County
Butte County
Sutter Bypass
Palermo
Live Oak
Yuba City
Grass Valley
Lincoln
South Fork Feather River
Lost Creek
Slate Creek
Canyon Creek
Oregon Creek
South Yuba River
Deer Creek
Reeds Creek
Hurricane Creek
Bear River
Feather River
Yuba River
Middle Yuba River
North Yuba River
South Honcut Creek
Dry Creek
Jack Slough
Strawberry Slough
Bear Slough
99
70
20
65

6.2 Communities and Planning Areas

Population centers in the Yuba County IRWMP region include the incorporated Cities of Marysville and Wheatland, both of which are located on the valley floor (see **Figure 6-1**). Other developed areas include the unincorporated communities of Linda, Olivehurst, Plumas Lake, and Loma Rica. Numerous smaller unincorporated communities are also distributed throughout the valley floor and foothill and mountain regions and include Browns Valley, Brownsville, Camptonville, Challenge, Dobbins, Oregon House, Rackerby, Smartsville, and Strawberry Valley.

6.3 Yuba County Region and Overlapping Integrated Regional Water Management Regions

The Plan area includes portions of the North Fork and all of the Main Stem and Lower river reaches and also incorporates portions of lower Honcut Creek, which is a subwatershed to the Feather River. The northern boundary is defined by Honcut Creek and the Feather River. The western boundary is defined by the Feather River and the southern boundary is defined by the Bear River and Dry Creek. All of the region's watersheds drain large volumes of water into the Sacramento River, ultimately serving the Sacramento-San Joaquin Delta ecosystems; therefore, the region is a supplier to, and not dependent upon, the Sacramento Delta water supply. The Yuba County IRWMP region and its watersheds are depicted on **Figure 6-2.**

6.3.1 Rationale for Yuba County Region Internal Boundaries

The Yuba County Regional Water Management Group (RWMG) identified the Yuba County region boundaries through a series of meetings conducted as part of planning for the 2008 IRWMP, and confirmed the boundaries during the 2009 Department of Water Resources (DWR) Region Acceptance Process. There are a number of unique challenges that define the proposed region, best addressed through cooperation of regional agencies and stakeholders:

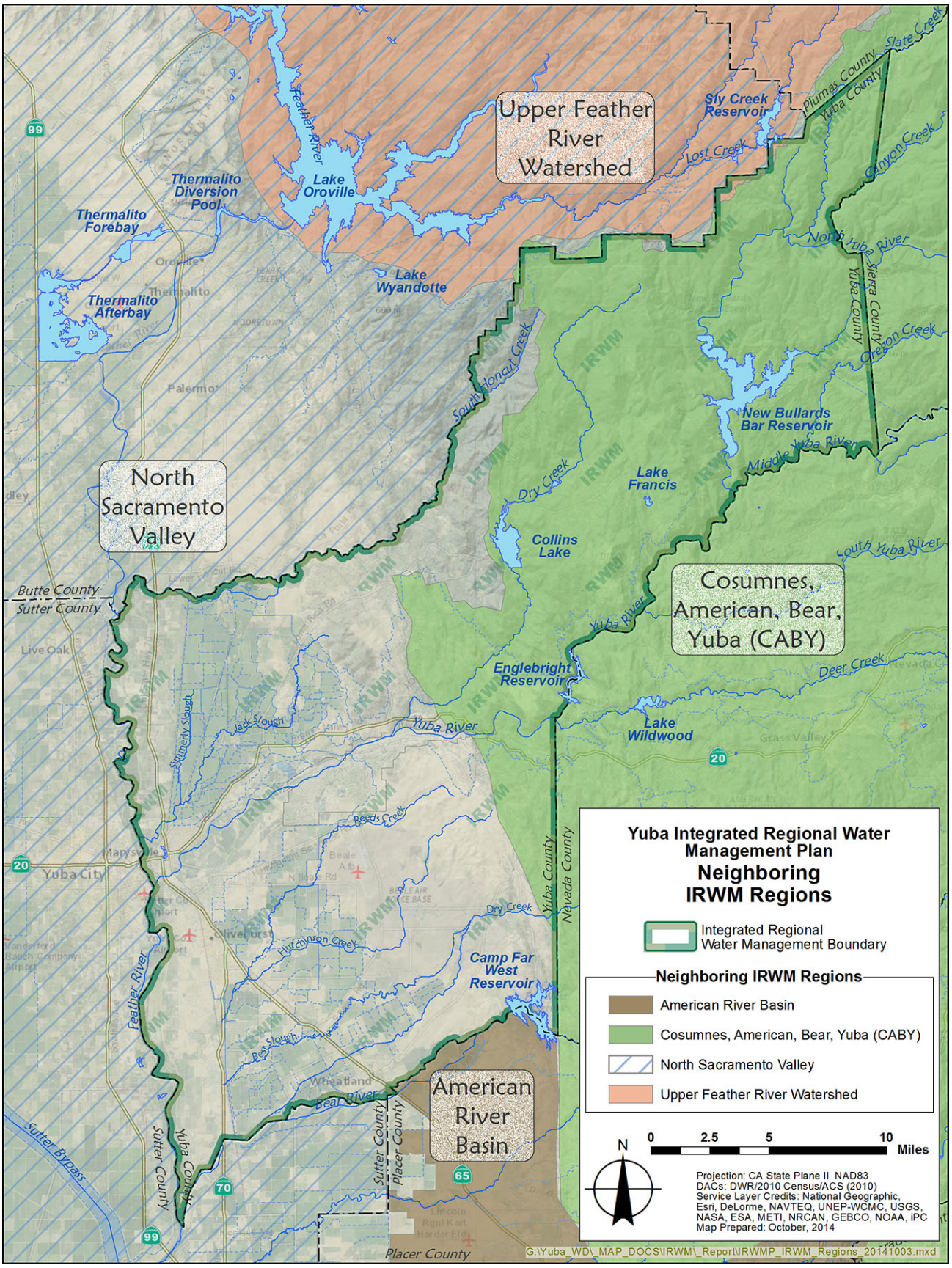
- a groundwater basin that has physical and institutional separations from the adjacent groundwater basins;
- the Lower Yuba River Accord, which manages flows to protect Chinook salmon and steelhead trout and is highly dependent on local surface water and groundwater conjunctive management operations;
- local flood control issues, such as those associated with Olivehurst, within the jurisdictions of local agencies in Yuba County;
- an agricultural-based economy that is experiencing urban development; and
- foothill and mountain areas with limited access to groundwater that share surface water resources with the valley floor area of the county.

6.3.2 Overlap with Nearby IRWM Regions

The Yuba County IRWMP region shares boundaries with five adjacent regions identified by DWR that are currently participating in the IRWM planning process (see **Figure 6-3**). These regions include the

American River Basin to the south, North Sacramento Valley IRWMP to the north, Upper Feather River IRWMP to the northeast, and the Cosumnes, American, Bear, Yuba (CABY) IRWMP directly to the east.

Figure 6-3


Upper Feather River Watershed
North Sacramento Valley
Cosumnes, American, Bear, Yuba (CABY)
American River Basin
Lake Oroville
Thermalito Diversion Pool
Thermalito Forebay
Thermalito Afterbay
Lake Wyandotte
Sly Creek Reservoir
New Bullards Bar Reservoir
Lake Francis
Collins Lake
Englebright Reservoir
Lake Wildwood
Camp Far West Reservoir
Feather River
Yuba River
Butte County
Sutter County
Yuba County
Nevada County
Placer County
Plumas County
Sierra County
Yuba City
Marysville
Live Oak
Palermo
Yuba Integrated Regional Water Management Plan
Neighboring IRWM Regions
Integrated Regional Water Management Boundary
Neighboring IRWM Regions
American River Basin
Cosumnes, American, Bear, Yuba (CABY)
North Sacramento Valley
Upper Feather River Watershed
0 2.5 5 10 Miles
N
Projection: CA State Plane II NAD83
DACs: DWR/2010 Census/ACS (2010)
Service Layer Credits: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC
Map Prepared: October, 2014
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The 2006 Sacramento Valley IRWMP to the south is currently being implemented and administered by Northern California Water Alliance (NCWA).

The region overlaps with two adjacent IRWMP regions, including CABY and North Sacramento Valley. Coordination efforts and the relationships with these adjacent planning regions are described below.

6.3.2.1 North Sacramento Valley Integrated Regional Water Management Plan

The original development of the North Sacramento Valley IRWMP moved forward concurrent with the 2008 Yuba County IRWMP. The two were complementary planning processes for the broader Sacramento region. According to language included in the North Sacramento Valley IRWMP, the process relies on subbasin-level water management strategies and integrates these strategies into a coherent larger-scale regional water management plan.

While the North Sacramento Valley IRWMP is focused on issues for the larger Sacramento Valley, the Yuba County IRWMP is focused on addressing more specific impacts within a substantially smaller geographic area. Regional information developed for the Sacramento Valley IRWMP was incorporated where appropriate into the Yuba County IRWMP.

These two planning processes were closely coordinated since some key stakeholders participated in the development of both plans. The coordinated approach facilitates the identification and pursuit of various funding opportunities that may be available to projects identified within both the IRWMPs.

6.3.2.2 Cosumnes, American, Bear, Yuba IRWMP

The CABY IRWM Plan Area overlaps with the Yuba County IRWM Plan Area in the upper elevations. The CABY IRWMP was prepared to identify potentially feasible opportunities, initiatives, programs, or projects to improve water supply, water quality, habitat, recreation, and land use in the four watersheds of the CABY region, and to provide a framework for implementation efforts.

The Sierra Nevada has water issues and conflicts unique to its geography and elevation. As a result, there can be significant differences between issues in the upper watershed compared to the lower elevation, valley floor areas. The CABY Plan area reflects this contrast limiting the western boundary of its Plan area to the transition zone between the Sierra Nevada and the Central Valley floor, at the 400 foot elevation.

In the 2009 Region Acceptance Process, Yuba County Water Agency (YCWA) and the RWMG recognized CABY as the appropriate entity to organize planning efforts in the Upper Yuba watersheds. This agreement was formalized via a Memorandum of Understanding (MOU). The MOU clarifies the relationship in the overlap area: that infrastructure projects above the 400-foot elevation will be coordinated by the Yuba County IRWM region, while natural resource and watershed-level projects in the overlap area will be coordinated through CABY. The MOU further clarifies that stakeholders in both regions will be informed of the project development process in each region and invited to review proposed projects within the overlap area to ensure that management issues for both IRWM regions are adequately reflected. If projects within either region present an issue, then the MOU stipulates a resolution process to ensure that divergent opinions or management priorities are reflected in final project design and implementation objectives.

6.4 Land Use

This section presents an overview of land uses in the region. **Table 6-1** summarizes land ownership distribution in Yuba County, while **Figure 6-4** depicts the land ownership distribution across the region.

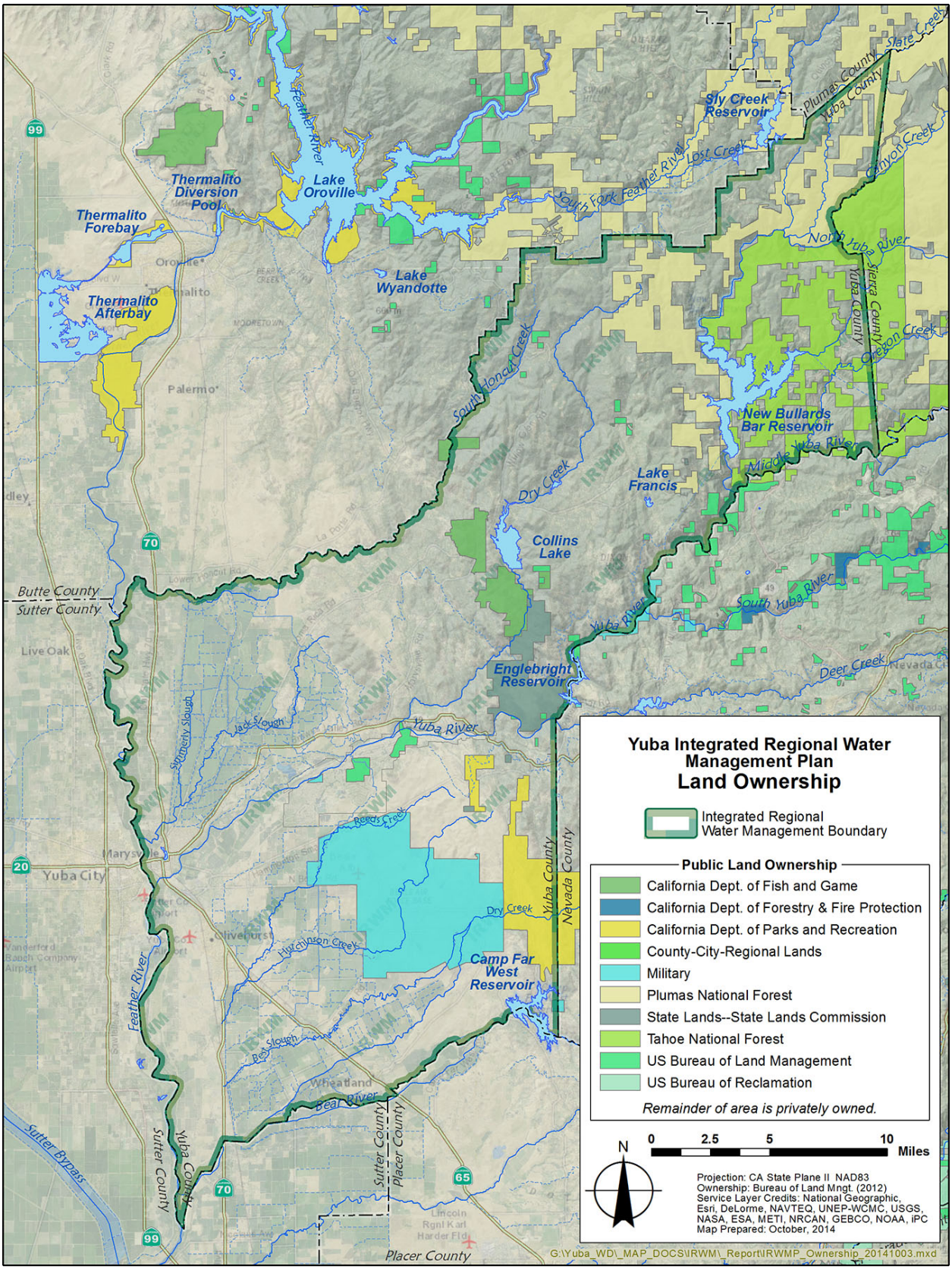
Table 6-1. Land Ownership Distribution in Yuba County

Agency/ Owner	Acres	Percent
Bureau of Land Management	**2,424.9**	**0.59%**
US Bureau of Land Management	2,424.9	0.59%
Military	**23,870.5**	**5.80%**
Military	23,870.5	5.80%
State	**13,801.0**	**3.35%**
California Dept. of Parks and Recreation	7,919.0	1.92%
State Lands - State Lands Commission	5,882.0	1.43%
US Forest Service	**14,869.9**	**3.61%**
Plumas National Forest	12,874.7	3.13%
Tahoe National Forest	1,995.2	0.48%
Unclassified	**356,891.4**	**86.65%**
California Dept. of Fish and Game	4,782.9	1.16%
California Dept. of Parks and Recreation	34.6	0.01%
Plumas National Forest	11,135.3	2.70%
State Lands - State Lands Commission	0.3	0.00%
Tahoe National Forest	19,324.7	4.69%
US Bureau of Land Management	221.6	0.05%
Unclassified/Private	321,391.9	78.03%
Grand Total	**411,857.6**	**100.00%**

6.4.1 Major Land Uses

Over the last few decades, the Yuba County IRWMP region has experienced a shift away from traditional rural land uses such as livestock grazing and irrigated agriculture, and toward urban residential developments. This trend has largely been driven by an influx of new residents from the 1990s through 2005. From 1996 to 2007 the population of Wheatland and Plumas Lakes increased by approximately 65 percent, while the population of the whole county increased by 20 percent from 2000 to 2010. Due to the levee system constructed to protect the City of Marysville in the 1950s, most growth has occurred in unincorporated areas of the valley floor with levee protection, and large areas of agricultural lands near State Routes 65 and 70 have been developed or approved for development. Three-quarters of Yuba County's population now lives outside the City of Marysville and nearby Yuba City. Even with this development, however, much of the fertile agricultural ground on the valley floor remains in active production, representing the single most important economic activity and most prevalent land use in the

Figure 6-4


Yuba Integrated Regional Water Management Plan
Land Ownership
Integrated Regional Water Management Boundary
Public Land Ownership
California Dept. of Fish and Game
California Dept. of Forestry & Fire Protection
California Dept. of Parks and Recreation
County-City-Regional Lands
Military
Plumas National Forest
State Lands--State Lands Commission
Tahoe National Forest
US Bureau of Land Management
US Bureau of Reclamation
Remainder of area is privately owned.
0 2.5 5 10 Miles
N
Projection: CA State Plane II NAD83
Ownership: Bureau of Land Mngt. (2012)
Service Layer Credits: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC
Map Prepared: October, 2014
G:\Yuba_WD_MAP_DOCS\IRWM_Report\IRWMP_Ownership_20141003.mxd
Lake Oroville
Thermalito Diversion Pool
Thermalito Forebay
Thermalito Afterbay
Lake Wyandotte
Sly Creek Reservoir
New Bullards Bar Reservoir
Lake Francis
Collins Lake
Englebright Reservoir
Camp Far West Reservoir
Feather River
South Fork Feather River
Lost Creek
Plumas County
Yuba County
Sierra County
North Yuba River
Middle Yuba River
South Yuba River
Yuba River
South Honcut Creek
Dry Creek
Deer Creek
Butte County
Sutter County
Placer County
Nevada County
Yuba City
Marysville
Live Oak
Palermo
Oroville
Wheatland
Sutter Bypass
Bear River
Reeds Creek
Hutchinson Creek
Jack Slough
Simmerly Slough
Bear Slough
Lincoln Rgnl Karl Harder Fld
IRWM

county.[1] Most foothill areas of the Yuba County IRWMP region have experienced only minor development with smaller subdivisions, although several pending development proposals could result in substantial land use changes in the future and a substantial increase in population of the foothill areas.[2]

Yuba County's population is expected to increase from 72,155 in 2010 to 143,973 in 2050, a twofold increase that equates to an average annual growth rate of about 2.5 percent.[3] Urban areas constitute about 16 percent (or 65,946 acres) of the land cover in Yuba County, but this is expected to change as the region accommodates a large increase in population per projections from Department of Finance/ Department of Water Resources. As a result of the adoption of the Yuba County 2030 General Plan in 2011, 8 percent of Yuba County's land area is now deemed "vacant" and is planned for development, a number that will ultimately result in urbanized uses comprising 24 percent of the county's land area.[4]

Private lands constitute about 50 percent of the Yuba County IRWMP region. Private ownership in the western part of the region consists mostly of urban residential and/or agricultural holdings, while in the upper watersheds, timber companies own and manage numerous tracts for commercial timber production.

The eastern part of the region is owned and managed by federal agencies (primarily Tahoe and Plumas National Forests and, to a lesser extent, the Bureau of Land Management, Bureau of Reclamation, US Army Corps of Engineers, US Fish and Wildlife Service, and Bureau of Indian Affairs). Public lands are often in a one-square-mile "checkerboard" ownership, a remnant of historic railroad development. Present-day impacts of such patterns present challenges to both the US Forest Service and private land managers.

6.4.2 Agricultural Land Use

In 1959 nearly 80 percent of Yuba County (about 329,728 acres) was considered active farmland by the US Department of Agriculture (USDA),[5] while in 2007 the number had dropped to just under 40 percent.[6] According to the USDA's 2007 Census of Agriculture, from 2002 to 2007, 73,231 acres of farmland were developed, resulting in a 31 percent decrease in farmland in only five years.[7] Yuba County's 2008 General Plan Update Background Report on Agriculture reported that from 1992 to 2006, approximately 3,480 acres of converted farmland had been designated by the state as Prime Farmland. Designated Prime Farmland has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. Fruit and nut crops comprise the majority of agricultural production in Yuba County (54 percent), followed by field and vegetable crops (predominantly rice at 26 percent), livestock and apiculture (17 percent), and timber (3 percent).[8]

[1] Yuba County, Yuba County 2030 General Plan (adopted June 7, 2009).
[2] Yuba County, General Plan Update Background Report (January 2008).
[3] US Census Bureau, quickfacts.census.gov; California Department of Finance, www.dof.ca.gov.
[4] Yuba County, General Plan Update Background Report (January 2008).
[5] USDA, Natural Agricultural Statistics Service, 1959 Census of Agriculture: California.
[6] USDA, Natural Agricultural Statistics Service, 2007 Census of Agriculture: Yuba County, California.
[7] Ibid.
[8] Yuba County, General Plan Update Background Report: Agriculture (January 2008).

6.4.3 Recreation

The variety of streams, creeks, and reservoirs within Yuba County provide a range of water-based recreational opportunities, including fishing, birding, boating, camping, picnicking, hiking, biking, horse-back riding, rafting, kayaking, tubing, and swimming. Many of these opportunities within the Plan area are associated with the Yuba River. This section provides a brief summary of the existing recreational opportunities.

6.4.3.1 Existing Yuba River Recreational Facilities

The Yuba River watershed drains over 1,300 square miles of the Sierra Nevada and foothill areas before flowing into the Feather River at Marysville. Implementation of the proposed Lower Yuba River Accord (along the 24-mile reach between Englebright Dam and the confluence with the Feather River) provides increased flows to enhance local fisheries. In addition, the higher flows provide further recreational opportunities along the river corridor. Some of the existing recreational opportunities along the Yuba River are described below.

6.4.3.2 New Bullards Bar Reservoir

New Bullards Bar Reservoir is located about 30 miles east of Marysville in the foothills at an elevation of about 1,900 feet. The reservoir has a surface area of 4,600 acres and approximately 55 miles of shoreline that support a variety of recreational activities including boating, water skiing, fishing, swimming, camping, picnicking, hiking, horseback riding, and biking. Biking and fishing occur year-round, while other activities occur primarily from early May to mid-October.

Existing recreational facilities at New Bullards Bar include:

- Three boat-in camping areas with 30 to 74 units (depending on reservoir water level)
- Two picnic areas with 44 units
- Marina
- Drive-in camping area with 72 campsites and five group sites
- Three parking areas, including two at boat launches
- Bullards Trail System – five trails over 20 miles in length for hiking, horseback riding, and biking

Recreational opportunities at the reservoir are supplemented by the surrounding Tahoe and Plumas National Forests, which provide additional nearby recreational opportunities, including camping, fishing, hiking, biking, off-road vehicle use, rafting, sightseeing, hunting, and horseback riding. Emerald Cove Marina operations are administered by YCWA, and campground operations are administered by the US Forest Service. Ranger patrols for law enforcement are operated by the US Forest Service and the Yuba County Sheriff's Office. Emergency, fire, and rescue services are provided by the Camptonville Fire Department in the Camptonville Community Service District.

6.4.3.3 Englebright Reservoir

Englebright Reservoir is situated north of State Highway 20, about 21 miles east of Marysville, at an elevation of 527 feet. The construction of the dam was completed in 1941 for the primary purpose of trapping sediment from mining operations. The reservoir has a surface area of 400 acres with a shoreline of 24 miles. Englebright provides only boat-access camping. Boats can be launched at the Englebright Lake Park Headquarters or at a private marina. Fishing is allowed, but waterskiing is limited to an area

upstream from the dam. Recreation operations are administered and enforced by the US Army Corps of Engineers (USACE) or deputies of the Yuba and Nevada County Sheriff's Departments.

6.4.3.4 Collins Lake Recreation Area

The Collins Lake Recreation Area is located at Merle Collins Reservoir, about 20 miles northeast of Marysville. The reservoir and recreation area are owned and operated by Browns Valley Irrigation District, an important non-potable water provider within its jurisdiction. The Recreation Area contains 186 campsites with hookups, campsites without hookups, 40 day-use picnic spaces, and an undeveloped open camping area. The Recreation Area includes some public facilities such as a store, laundry, rest-rooms, showers, and an RV dump station. There is a single boat ramp for fishing and water skiing, but no personal watercraft or house boats are allowed. Plans exist to expand the camping facilities.

6.4.3.5 Main Yuba River

There are no public recreation facilities for the seven miles of the Main Yuba River above Englebright Reservoir.

Few public recreation facilities are available along the Yuba River below New Bullards Bar Dam. From Englebright Lake to the Feather River at Marysville, the river flows primarily past private lands. Public access to the Lower Yuba River is found at the following locations:

- the State Highway 20 crossing at Parks Bar bridge, five miles downstream of Englebright Lake (limited public access on the south and north banks of the Yuba River);
- Hammon Grove County Park and the adjacent Sycamore Ranch Park and Campground located just west of Hammon Grove Park where Dry Creek enters into the Yuba River;
- the end of Hallwood Boulevard, on the north bank of the Yuba River, approximately six miles east of Marysville south of State Highway 20 (there is no parking area but access is sometimes allowed with permission); and
- through the Riverfront Park in Marysville.

Although powerboat access is available from launches on the Feather River near the confluence with the Yuba River, boats traveling up the river cannot pass Daguerre Point Dam approximately 12 miles upstream of the confluence. A Yuba County ordinance prohibits recreational and commercial power boating above Daguerre Point Dam.

Rafters can access the Yuba River on either bank of the river at Parks Bar below the State Highway 20 crossing and float downstream for eight to ten miles. This section of the river is not commonly run by whitewater enthusiasts due to a long portage around Daguerre Point Dam and limited public river access.

Fishing, including fishing for native salmon, is common along the Yuba River. Anglers can fish from shore at access points available to the public, from boats that travel upstream of the Feather River, and from boats launched near the State Highway 20 crossing. Prime fishing season is March through May and August through November, and winter fishing is popular in December through February.

6.4.3.6 Yuba River Recreation and Wildlife Enhancement Area

The Yuba River Recreation and Wildlife Enhancement Area is located along the Yuba River between Parks Bar Road and the City of Marysville, an area protected from encroachments incompatible with

recreational and wildlife uses and suitable for recreational uses, such as camping, fishing, hiking, bike riding, equestrian use, and river rafting.

6.4.3.7 Riverfront Park (City of Marysville)

Riverfront Park consists of a large complex about 3.6 acres with many of the facilities located in the river floodplain. Facilities include restrooms, athletic fields, and a motocross park. Riverfront Park is also a popular venue for music and other special events. The City of Marysville is looking to encourage the development and use of compatible recreational uses such as hiking, mountain biking, and fishing in the floodplains of the Feather and Yuba Rivers.

6.4.3.8 Yuba County Parks

Hammon Grove Park

This 43.6-acre park is owned by Yuba County and is located near Dry Creek on the Yuba River. The park sits where the historical town of Long Bar once flourished. It serves as a large-group picnic area and as an access point to the river. Existing facilities include parking, picnic areas, a large BBQ area with picnic tables, and restrooms. A one-mile trail with signage follows the perimeter of the park.

Sycamore Ranch Park and Campground

This 90-acre park and campground is owned by Yuba County and is located near Dry Creek on the Yuba River. The park sits adjacent to Hammon Grove Park. The existing facilities include RV camping sites, tent camping, picnic areas, restrooms and showers, a dump station, clubhouses, Yuba River access, and hiking trails. The park is used annually by the Tsi-Akim Maidu Tribal community for Indigenous Peoples' Day educational events and for a traditional Yuba River salmon ceremony each October.

Oregon Creek Picnic and Water Recreation Facilities

This day-use recreation area owned by Yuba County is located at the confluence of Oregon Creek and the Middle Yuba River, adjacent to the historic covered bridge built in 1880. It includes 11 picnic tables and a swimming and wading area.

Shad Pad (E Street Motor Park)

This 16-acre motor park owned by Yuba County is located on the south bank and is adjacent to the Yuba River across from the City of Marysville, east of the State Highway 70 bridge. The Shad Pad includes a motocross course. In addition, the National Marine Fisheries Service (NMFS) recovery plan for the Central Valley salmon identified the relocation of the motocross as a target action.

6.4.3.9 Existing Bear River Recreational Facilities

Most of the Bear River watershed above Camp Far West Reservoir is located outside of Yuba County in the foothills of Nevada and Placer Counties. Much of the Bear River is either inaccessible or closed to the public, which limits recreational opportunities.

6.4.3.10 Camp Far West Reservoir

Camp Far West Reservoir is used for fishing, boating, and water skiing and also has 800 acres of open camping and trails for hikers, bikers, and equestrians. At an elevation of 320 feet, Camp Far West Reservoir is located at the junction of Yuba, Nevada, and Placer Counties. At full capacity the reservoir

stores 104,500 acre-feet (af) of water and has a surface area of 2,000 acres and 29 miles of shoreline. Camp Far West Reservoir has over 50 campsites for groups, including equestrians.

6.4.3.11 City of Wheatland

The City of Wheatland currently has less than five acres of parks. The Wheatland General Plan Update (2006) identifies the need to increase recreational opportunities within the growing community. The city has considered potential uses of local waterways to improve public access to creek and river channels, establish riparian and scenic values, and promote the continued support and maintenance of the creeks and trail systems. Specific designs have been considered, as well as development plans along Grasshopper Slough.

6.4.3.12 Existing Feather River Recreational Facilities

Common activities along the Feather River include boat and shore fishing, pleasure boating, hunting, swimming, sightseeing, picnicking, and camping. In Yuba County, boat access to the Feather River is available at Riverfront Park in Marysville and at Star Bend near Plumas Lake.

The Feather River State Wildlife Area is located south of Marysville and Yuba City in both Yuba and Sutter Counties. The Wildlife Area is managed by the California Department of Fish and Wildlife (CDFW). Existing Feather River State Wildlife Area facilities located within Yuba County include the Star Bend Unit, a 50-acre site near Star Bend. The county owns and operates a nine-acre park at this location that includes a paved parking area and boat ramp. Lake of the Woods Unit is a 698-acre site along the Feather River extending from south of the Star Bend boat ramp to the Bear River and is only accessible by boat.

6.4.3.13 Local Agencies with Recreation and Public Access Management Responsibilities

Yuba County and Yuba County Resource Conservation District (RCD) are the primary local agencies with the interest and authority to develop and manage recreational facilities in the region. Browns Valley Irrigation District has recreational opportunities associated with some of its facilities as well.

According to the Yuba County website, there are 42 county parks. The Yuba County Park Master Plan was adopted in February 2008; the county is currently preparing a Park Master Plan and Capital Improvement Plan to identify needs for county parks and facilities.

6.4.3.14 Yuba County Resource Conservation District

The role of the Yuba County RCD includes assisting local landowners and land managers in providing stewardship of the county's natural resources and educating stakeholders and policy makers about the county's natural resource base. As part of this effort, the Yuba County RCD has identified several projects located along the Yuba River that provide the opportunity to protect and preserve the natural resources while also providing additional recreational and public access opportunities to the river.

6.4.4 Conservation Areas

A number of critical ecosystem preservation and enhancement areas are located within the Yuba region. These conservation areas are designed to protect the extensive fisheries, riparian, plant, and wildlife resources found in Yuba County, and in some cases to provide recreational opportunities (e.g. hiking, wildlife viewing, fishing, and hunting) as well. These areas include Spenceville Wildlife Management and

Recreation Area, Marysville Wildlife Area, Feather River Wildlife Area, Daugherty Hill Wildlife Area, CDFW Fish Access Areas, and UC Sierra Foothill Research and Extension Center. Bobelaine Audubon Sanctuary in adjoining Sutter County is also an important resource as well. The Yuba River Wildlife Area Conservation Conceptual Area Protection Plan coordinates CDFW acquisition and management activities on more than 81,000 acres of the Yuba River corridor.

6.4.4.1 Joint/Regional Habitat and Natural Community Conservation Plans

The Yuba County General Plan describes the land use planning for the entire IRWM Plan Area. The county is currently collaborating with Sutter County, Yuba City, the City of Wheatland, and the City of Live Oak to prepare the Yuba Sutter Regional Conservation Plan (RCP) that is both a Federal Habitat Conservation Plan and a State Natural Community Conservation Plan. The RCP is a voluntary effort that will provide streamlined federal and state Endangered Species Act (ESA) and wetlands permitting for transportation projects, land development, and other covered activities over the 50-year term of the permits. It will also provide comprehensive species, wetlands, and ecosystem conservation and contribute to the recovery of endangered species within the RCP area.

6.5 Economic and Social Environment

This section presents an overview of the economic attributes, social and cultural makeup, and demographics of the region.

6.5.1 Regional Economic Conditions and Trends

Historically, jobs in the Yuba County IRWMP region were focused in areas of agriculture, timber, and mining. Over the past few decades the economy has been shifting to services. Manufacturing and technological industries, professional and business services, financial activities, construction, trade, transportation, and utilities make up the majority of the industry sector. Natural resources and extractive industries have decreased in both economic makeup and percent of job contributions in the past 10 years, and are now a small part of the industry sector.

Employment in the Yuba County IRWMP region tracks generally with the state as a whole. While Yuba County increased its labor force 11.3 percent between 2000 and 2014 (higher than the Sacramento region, Bay Area, or California), its unemployment rate also increased 4.8 percent during this time period to 12.7 percent.[9]

Agriculture and agriculture-related industries, military operations (e.g., Beale AFB), governmental institutions, industry, and recreation are primary economic drivers of Yuba County's economy. Historically, both the valley floor and foothill areas of Yuba County have depended on an agriculture-based economy. The gross value of crop production in 2003 was $154.6 million, with rice, peaches, prunes, and walnuts the primary crops. In 2012, the gross value of agricultural production had increased to nearly $213 billion, a number that reflects the sustained value of agriculture to Yuba County's economy. As discussed previously, however, the county is continuing to urbanize.

[9] EDD LMI for Yuba County, California.

The growth-related challenges facing the region include the conversion of agricultural land to residential use, changes in groundwater use and water quality, an increased dependence on groundwater to meet urban water demands, and additional needs for flood protection for existing and developing areas on the valley floor. These changes present challenges to ecosystems as well as open space as it becomes developed.

Availability of water is highly important to the economic stability of the region. Recreational use relies on surface water to attract anglers, hunters, wildlife watchers, and others who in turn support local businesses.

6.5.2 Population and Demographics

The US Census Bureau estimates the 2012 population of Yuba County at 72,926.[10] Yuba County's population increased rapidly during the boom years of the 1990s to the early part of the 2000s, with a 20 percent increase from 2000 to 2010. Population centers are mostly located along State Routes 65 and 70. Yuba County's population is expected to increase from 72,155 in 2010 to 143,973 in 2050, a twofold increase that equates to an average annual growth rate of about 2.5 percent.[11]

Yuba County has experienced rapid population growth in the recent past. According to the California Department of Finance, Yuba County's total population increased from 60,219 in 2000 to 72,155 in 2010, with 22 percent in incorporated areas and 78 percent in unincorporated areas. The county's projected growth rate through 2050 is the second-highest in the state (after neighboring Sutter County).[12]

Based on the 2010 census, the two largest ethnic groups include White (79.7 percent) and Hispanic/Latino origin (26.2 percent). There are about 24,133 households, with an average of 2.94 people per household. The Yuba County Year 2010 median household income was about $46,641, and 20.6 percent of the population is living below the poverty level.[13]

6.5.3 Disadvantaged Communities

6.5.3.1 Definition of a Disadvantaged Community Based on DWR Guidelines

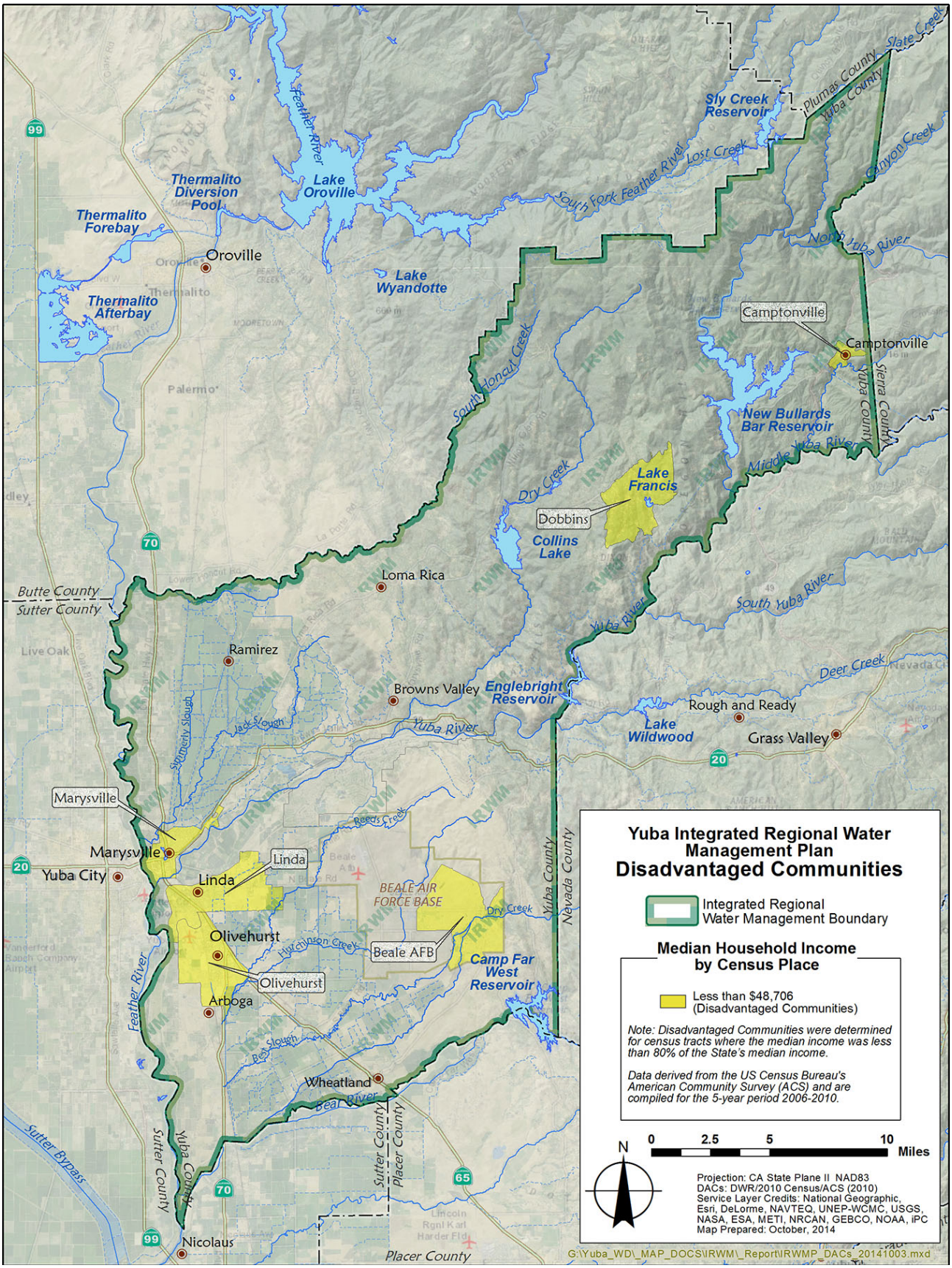
In the IRWMP process, a Disadvantaged Community (DAC) is defined as a community with an annual median household income (MHI) less than 80 percent of the statewide annual MHI. Based on the 2010 Census, seven communities within the Yuba County IRWMP region are now identified as DACs (MHI is $48,706 or below). The statewide annual MHI in California in 2010 was $57,708.[14] The communities in the Yuba County IRWMP region that qualify as DACs are listed in **Table 6-2** below. **Figure 6-5** displays the location of DACs in Yuba County.

[10] US Census Bureau, State and County QuickFacts, Yuba County, California
[11] US Census Bureau, QuickFacts.census.gov; California Department of Finance, www.dof.ca.gov.
[12] US Census Bureau, State and County QuickFacts, Yuba County, California
[13] Ibid.
[14] US Census Bureau, American Fact Finder, http://factfinder2.census.gov.

Table 6-2. Communities in the Yuba County IRWMP Region Designated as Disadvantaged (less than 80 percent of the California median household income)	
Census Places	**MHI**
Dobbins (just east of Oregon House)	$37,162
Camptonville	$21,667
Beale AFB	$41,917
Marysville	$34,351
Olivehurst	$42,565
Linda	$37,364
Smartsville	$42,083

Source: US Census Bureau, American Factfinder, Selected Economic Characteristics: 2008-2012 American Community Survey 5-year Estimates, http://factfinder2.census.gov.

Figure 6-5


Yuba Integrated Regional Water Management Plan
Disadvantaged Communities
Integrated Regional Water Management Boundary
Median Household Income by Census Place
Less than $48,706 (Disadvantaged Communities)
Note: Disadvantaged Communities were determined for census tracts where the median income was less than 80% of the State's median income.
Data derived from the US Census Bureau's American Community Survey (ACS) and are compiled for the 5-year period 2006-2010.
0 2.5 5 10 Miles
N
Projection: CA State Plane II NAD83
DACs: DWR/2010 Census/ACS (2010)
Service Layer Credits: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC
Map Prepared: October, 2014
G:\Yuba_WD_MAP_DOCS\IRWM_Report\IRWMP_DACs_20141003.mxd
Lake Oroville
Thermalito Diversion Pool
Thermalito Forebay
Thermalito Afterbay
Oroville
Lake Wyandotte
Sly Creek Reservoir
Plumas County
Yuba County
Slate Creek
Lost Creek
South Fork Feather River
Canyon Creek
North Yuba River
Camptonville
Sierra County
New Bullards Bar Reservoir
Middle Yuba River
South Honcut Creek
Dry Creek
Lake Francis
Dobbins
Collins Lake
Loma Rica
Butte County
Sutter County
South Yuba River
Yuba River
Ramirez
Browns Valley
Englebright Reservoir
Deer Creek
Rough and Ready
Lake Wildwood
Grass Valley
Jack Slough
Marysville
Yuba City
Linda
Reeds Creek
BEALE AIR FORCE BASE
Beale AFB
Olivehurst
Hyncinson Creek
Camp Far West Reservoir
Arboga
Feather River
Best Slough
Wheatland
Bear River
Sutter Bypass
Nicolaus
Placer County
Nevada County

6.5.4 California Native American Tribes

Tribal entities in the Plan area have been identified and contacted as shown in **Table 6-3**. For further discussion see Chapter 5 *Disadvantaged Communities, Environmental Justice, and Native American Tribal Considerations*.

Table 6-3. Tribal Distribution List	
Nevada City Rancheria	Washoe Tribe of Nevada and California
Tsi Akim Maidu	United Auburn Indian Community
Concow Maidu Tribe of Mooretown Rancheria	Greenville Rancheria Tribe of Maidu Indians
Mechoopda Indian Tribe of Chico Rancheria	Shingle Springs Rancheria
Tyme Maidu Tribe of Berry Creek Rancheria	Pakan-Yani Band of Strawberry Valley Rancheria
Maidu/Miwok	Nisenan/Maidu
Enterprise Rancheria of Maidu Indians	Maidu Nation
Tyrone Gorre	Maidu Cultural and Development Group
Colfax-Todd Valley Consolidated Tribe	Susanville Indian Rancheria
Estom Yumeka Maidu Tribe	

6.6 Environmental Setting

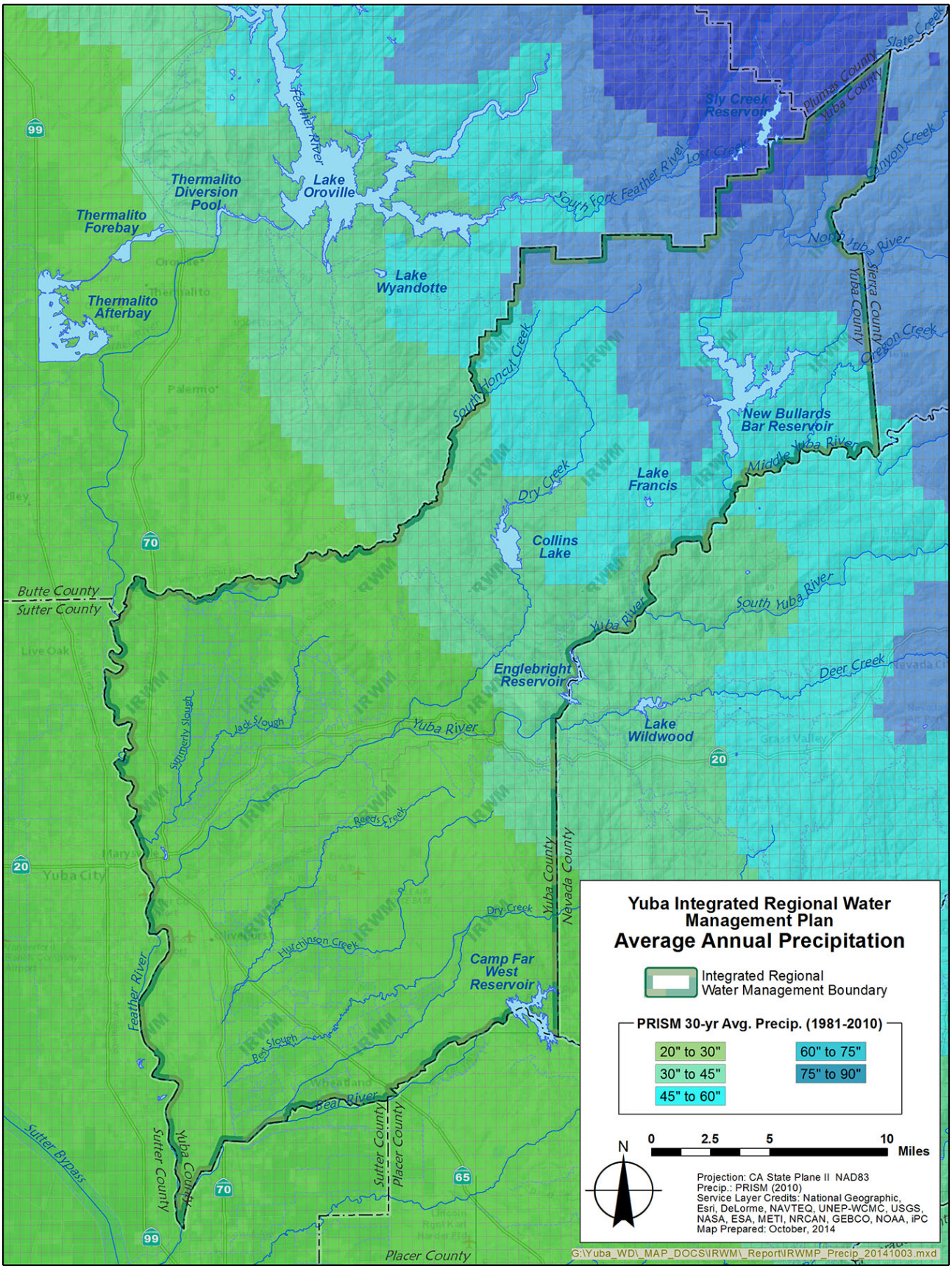
This section presents an overview of the environmental setting in the Yuba County IRWMP region. The environmental setting provides the foundation for management of all natural resources in the area and is critical to understanding the sometimes competing interests within the region.

6.6.1 Climate and Precipitation

The climate of the Yuba County IRWMP region is characterized by hot, dry summers and mild, wet winters, but the variability in climate over the project area differs due to the topographic and elevation ranges. The valley floor receives less than 10 inches of precipitation per year. Precipitation generally increases with elevation in the Yuba County IRWMP region, and average annual precipitation ranges up to 22.5 inches in the highest, most eastern elevations of the planning region. See **Figure 6-6** for an illustration of average annual precipitation across the region. Snow levels are generally near 3,500 feet in the winter and rarely reach as low as the valley floor.[15] Average temperatures in the region generally decrease from west to east with elevation; in the summer months, temperatures tend to be warmer in the lower elevations (70°-100°F) and cooler at the higher elevations (60°-80°F). The winter months are mild at the lower elevations (45°-60°F), and cooler at the higher elevations (30°-50°F). Moreover, a wide variety of micro-climatic variations based on local topography and airflow affect local ecosystem characteristics.

[15] Nevada Irrigation District, Urban Water Management Plan (2005).

Figure 6-6


Yuba Integrated Regional Water Management Plan
Average Annual Precipitation
Integrated Regional Water Management Boundary
PRISM 30-yr Avg. Precip. (1981-2010)
20" to 30"
30" to 45"
45" to 60"
60" to 75"
75" to 90"
0 2.5 5 10 Miles
N
Projection: CA State Plane II NAD83
Precip.: PRISM (2010)
Service Layer Credits: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC
Map Prepared: October, 2014
G:\Yuba_WD_MAP_DOCS\IRWM_Report\IRWMP_Precip_20141003.mxd
Lake Oroville
Thermalito Diversion Pool
Thermalito Forebay
Thermalito Afterbay
Lake Wyandotte
Sly Creek Reservoir
New Bullards Bar Reservoir
Lake Francis
Collins Lake
Englebright Reservoir
Lake Wildwood
Camp Far West Reservoir
Feather River
South Fork Feather River
Lost Creek
Plumas County
Yuba County
Slate Creek
Canyon Creek
North Yuba River
Sierra County
Oregon Creek
South Honcut Creek
Middle Yuba River
Dry Creek
South Yuba River
Deer Creek
Yuba River
Jack Slough
Reeds Creek
Hutchinson Creek
Bear Slough
Bear River
Butte County
Sutter County
Nevada County
Placer County
Sutter Bypass
Palermo
Live Oak
Yuba City
Marysville
Wheatland
Grass Valley
Nevada City
99
70
20
65

6.6.2 Hydrology and Groundwater

A groundwater basin is defined as an area underlain by permeable materials capable of furnishing a significant supply of groundwater to wells, or storing a significant amount of water. It includes both the surface extent and all of the subsurface freshwater-yielding material. These underground reservoirs along with the surface waters comprise the water resources of the Yuba County IRWMP region.

Groundwater basins are delineated for some parts of California and subdivided into subbasins to distinguish groundwater systems. Many of these boundaries are not precise and little is known about the hydrogeology and groundwater levels of many of the basins, especially in the foothill regions. The Yuba planning area occurs primarily in the Sacramento River Hydrologic Region (the Feather, Yuba, and Bear watersheds) and Yuba County is divided into two subbasins, North Yuba and South Yuba. There is a large range of availability and accessibility to groundwater within Yuba County, discussed in more detail in Chapter 7 *Water Supply*.

6.6.3 Hydrology and Surface Water Resources

Although the state recognizes numerous subwatersheds, for the purposes of this planning effort, the Yuba County IRWMP region is divided into six major subwatersheds that flow into the Sacramento River (see **Table 6-4**). The Sacramento and the San Joaquin Rivers form the Sacramento-San Joaquin Delta, an expansive delta consisting of many small, natural and man-made sloughs that create a system of isolated lowland islands and wetlands defined by dikes or levees.

The headwaters of the Yuba, Bear, and Feather Rivers originate in the Sierra Nevada and flow west into the Central Valley. Each of the watersheds is highlighted below.

Table 6-4. Major Subwatersheds in the Yuba County IRWMP Region

Watershed	Acres	Percent of Yuba Region
Bear River	50,367	12.23%
Dry Creek	68,375	16.61%
Feather River	134,431	32.64%
Middle Yuba River	12,612	3.06%
North Yuba River	61,099	14.83%
South Honcut Creek	29,661	7.20%
Yuba River	55,313	13.43%
Grand Total	**411,858**	**100.00%**

Yuba River Watershed

The Yuba River has three forks (North, Middle, and South Yuba) that converge northwest of Nevada City. The North Yuba and the Middle Yuba Rivers converge below New Bullards Bar Reservoir and form the Main Stem of the Yuba River. The Main Stem flows into the north arm of Englebright Reservoir, while the South Yuba feeds the south arm. The Yuba River flows west out of Englebright Reservoir (hereafter,

referred to as the Lower Yuba), and eventually out of the Yuba County IRWMP region and into the Feather River at Yuba City, just west of Marysville. The Feather River is tributary to the Lower Sacramento River, which eventually flows into the Sacramento-San Joaquin Delta. The Yuba River watershed, from the crest of the Sierra Nevada to the confluence at the Feather River, near Marysville, is approximately 1,340 square miles; elevations in the watershed range between 9,100 feet and 30 feet above sea level.[16]

Over 100 "jurisdictional" dams (impoundments over 25 feet tall and that hold more than 50 af of water) or diversions lie within the Yuba watershed. Diversions convey water both to local users and to the Bear River and the North Fork American River watersheds. A large amount of water is diverted at Lake Spaulding on the South Fork for irrigation, power generation, and consumptive use.

Bowman Lake, Fordyce Lake, Lake Wildwood, Jackson Meadows Reservoir, Merle Collins Reservoir, New Bullards Bar Reservoir, Lake Spaulding, and Englebright Reservoir are some of the more prominent reservoirs here. South Yuba River watershed alone supports 20 reservoirs and 20 hydroelectric dams.

Englebright Dam marks the division between the Upper and Lower Yuba River. It was completed in 1941 to act as a catchment for Gold Rush-era hydraulic mining debris that threatened downstream areas and is not designed as a flood-control dam. Englebright Reservoir has a storage capacity of 45,000 af and provides hydrogeneration and recreational opportunities. Wild Chinook salmon spawning habitat exists below Englebright Dam, but lacks fish passage facilities to the Upper Yuba River.[17] Flows on the Lower Yuba River below Englebright Dam are managed to protect Chinook salmon and steelhead trout per the Yuba Accord.[18]

The patchwork of landownership in the watershed presents land and watershed management challenges. Many potential or actual impaired water bodies are listed in the Yuba River watershed. The Upper Yuba is also considered a "priority watershed" for increased restoration activities due to impaired water quality or other impaired natural resource goals by the state under the California Unified Watershed Assessment.

Below are descriptions of the five distinct reaches of the Yuba watershed: the North, Middle, and South Yuba Rivers and the Main Stem Yuba (from the confluence of the North and Middle Yuba Rivers to Englebright), and the Lower Yuba (from below Englebright to the confluence with the Feather River).

Lower Yuba River Accord

In March of 2008, after a lengthy, multi-year process, the State Water Resources Control Board (SWRCB) approved a consensus-based, comprehensive program known as the Lower Yuba River Accord (Yuba Accord), to protect and enhance 24 miles of aquatic habitat in the Lower Yuba River. The Yuba Accord is critical to the natural resources setting of the Yuba watershed and integrates three agreements:

Fisheries Agreement: After years of negotiation, a rigorous and collaborative effort resulted in development of the Fisheries Agreement and established in-stream flow requirements for the Lower Yuba River's salmon and steelhead. The Fisheries Agreement is the Accord's foundation. It is based on a

[16] Upper Yuba River Studies Program Study Team, Upper Yuba River Watershed Chinook Salmon and Steelhead Habitat Assessment (2006).
[17] Ibid.
[18] Lower Yuba River Accord (2007). http://www.ycwa.com/projects/detail/8.

detailed scientific analysis, which included a full evaluation of the various life stages of fall-run and spring-run Chinook salmon and steelhead.[19] The agreement settles longstanding disputes regarding adequate streamflow, flow fluctuations, and water temperatures.

A key provision of the Fisheries Agreement was establishment of the "River Management Fund," financed by YCWA which created a "River Management Team" (RMT), consisting of representatives from YCWA, NMFS, USFWS, CDFW, PG&E, DWR, and the conservation groups who are parties to the Fisheries Agreement. The RMT has developed a monitoring and evaluation program to evaluate the Accord's results and determine whether implementation of the Yuba Accord is maintaining fish in good condition and achieving viable salmonid populations.

The Fisheries Agreement included a flow pattern with higher summer flows to maintain cooler river temperatures and stable, higher fall flows for spawning. This regime is different from the natural hydrograph, but provides a more optimal set of conditions for the Lower Yuba River.[20]

1. **Conjunctive Use Agreement**: This agreement between YCWA and local irrigation districts enhanced groundwater-substitution transfer opportunities for the local irrigation districts while establishing a comprehensive groundwater management program to ensure the sustainability of the aquifer and the long-term reliability of local water supplies.
2. **Water Purchase Agreement**: This agreement called for a unique level of cooperation among state and federal project operations and YCWA to utilize some of the Fisheries Agreement's higher flows as "transferable" water supplies for statewide uses, under agreed-upon conditions.

The Yuba Accord took nearly three years to develop and involved intense negotiations and collaboration among 17 stakeholders, including local irrigation districts, state and federal resource agencies, and conservation groups. The program is based on two one-year pilot programs (2006/2007) and the State of California approved the agreement in 2008. Today the Yuba Accord is fully operational and is considered unique because it balances multiple uses to benefit fisheries resources: combining increased in-stream fisheries flows for wild, native salmon and steelhead with increased supplemental water supplies for California cities and farms, while preserving YCWA hydropower generation capacity. The Yuba Accord also reaffirms the water rights of the YCWA and its member irrigation districts.

North Yuba River

The North Yuba flows for 45 miles from the Yuba Pass area and is the largest reach of the river in the Yuba basin, draining an area of approximately 314,000 acres. Just downstream of its alpine headwaters, it follows along Highway 49, past Downieville, where it is joined by the Downie River. As it continues in a westerly direction it is joined from the north by three significant tributaries: Goodyears Creek, Canyon Creek, and Slate Creek. The North Yuba River flows into the north arm of New Bullards Bar Reservoir (owned and operated by YCWA), and Willow Creek flows into the south arm of the reservoir. New Bullards Bar dam is PG&E's largest source of power within the Plan area. It is important to note that as a part of the 2016 relicensing process, PG&E's power purchase agreement with YCWA will expire, allowing

[19] Aikens, Curt, Hydro Review Article (2011). http://www.hydro.org/about-nha/awards/osaw/2008-winners/yuba-county-water-agency/
[20] Ibid.

YCWA to sell power by new terms. The North Yuba River contributes nearly 50 percent of the total natural flow of the Yuba River originating above the foothills.[21]

Middle Yuba River

The Middle Yuba watershed drains an area of approximately 135,000 acres situated between the larger North and South Yuba Rivers. The Middle Yuba River originates from springs near Meadow Lake in the high Sierra near the crest and initially flows northwest, then west-southwest to its confluence with the North Yuba just south of New Bullards Bar Reservoir. Just downstream from its headwaters, the Middle Yuba River passes through Jackson Meadows Reservoir, the largest impoundment in this reach of the river. Just downstream are Milton Reservoir and the Milton-Bowman Canal that diverts most of the water from the Middle Yuba River to the South Yuba River.

Downstream of Milton Reservoir, the Middle Yuba River flows west, just south of Lafayette Ridge. Draining the north slope of Lafayette Ridge and the south slope of Pliocene Ridge, a major tributary to the Middle Yuba, Kanaka Creek enters the Middle Yuba from the north in the lower half of the watershed. Kanaka is a 303(d)-listed water body due to arsenic contamination from historic mining (see **Tables 8-1** and **8-2** and **Figure 8-1** for complete details on 303(d)-listed water bodies in the Yuba region). Other factors, such as low flows and high temperatures on the South and Middle Yuba Rivers, along with the legacy of sediment from hydraulic mining, have contributed to problems for the cold-water-adapted aquatic communities such as Chinook salmon. Downstream of Kanaka Creek, Oregon Creek, the Middle Yuba River's largest tributary, enters the river just upstream of the confluence with the North Yuba, just downstream of New Bullards Bar Reservoir. The Lohman Ridge Diversion Tunnel and Camptonville Diversion Tunnel move water from the Middle Yuba River and one of its tributaries, Oregon Creek, to New Bullards Bar Reservoir. Our House Reservoir feeds water from the Middle Yuba River to New Bullards Bar Reservoir.

South Yuba River

South Yuba River originates near Castle Peak/Donner Pass (Mt. Lola at 9,148 feet) near the Sugar Bowl Ski Resort. The South Fork drains an area of 225,000 acres. From its headwaters, the river parallels Interstate 80 until it runs into Lake Spaulding, a water management impoundment. The Yuba-Bear Project (Federal Energy Regulatory Commission [FERC] #2266) and the Drum-Spaulding Project (FERC #2310) originate at Lake Spaulding. Fordyce Creek also feeds Lake Spaulding from the northeast, as it drains the high country surrounding Fordyce Lake, another large impoundment.

Downstream of Lake Spaulding, the South Yuba drains west, separated from the Middle Yuba by the San Juan Ridge to the north and a series of small ridges to the south (that separate the South Yuba drainage from the Upper Bear and Deer Creek [a subbasin to the Yuba watershed] drainages). Along this stretch, several tributaries, including Fall Creek, Canyon Creek, Scotchman Creek, and Poorman Creek feed the South Yuba River. Near the Malakoff Diggins area (one of the largest hydraulic mining sites in the region), Humbug Creek enters the South Yuba. The creek is a 303(d)-listed waterway for sediment, mercury, copper, and zinc.

Thirty-nine miles of the South Yuba River (between Lake Spaulding and Englebright Reservoir) is a designated California Wild and Scenic River and a federally recommended Wild and Scenic River. It is

[21] Upper Yuba River Studies Program Study Team, Upper Yuba River Watershed Chinook Salmon and Steelhead Habitat Assessment (2006).

used heavily for recreational purposes. A few miles downstream of Bridgeport, the South Yuba flows into Englebright Reservoir.

Main Stem Yuba River

The 165,000-acre Main Stem spans the width of the Yuba River watershed. The Main Stem of the Yuba River is formed by the confluence of the North Yuba and the Middle Yuba Rivers just downstream of New Bullards Bar Reservoir. The Main Stem and the South Yuba Rivers form the north and east arms of Englebright Reservoir. Englebright Reservoir is a "debris dam" built by the US Army Corps of Engineers in 1941. The US Geological Survey has recently characterized the quantity and contamination levels of sediment in Englebright[22] and it is now a 303(d)-listed site (**Table 8-1**).

Lower Yuba River

Below Englebright, the Main Stem Yuba is often referred to as the Lower Yuba, a 24-mile reach from the base of Englebright to the confluence with the Feather River near Marysville. Dry Creek, a major tributary in this subwatershed, begins northwest of New Bullards Bar Reservoir, and flows south through Merle Collins Reservoir, and eventually into the Yuba River.

Deer Creek enters the Yuba River below Englebright Dam, just below Lake Wildwood. Deer Creek drains an area of 90 square miles and is a major tributary. The Deer Creek watershed is the most developed in the Yuba basin, as Deer Creek runs directly through Nevada City in neighboring Nevada County. Consequently, the Deer Creek watershed has been significantly degraded, and contains three 303(d)-listed water bodies, listed for mercury or pH. The three water bodies are Scotts Flat Reservoir on Deer Creek, Deer Creek itself, and Little Deer Creek, a tributary to Deer Creek and the main water supply for Nevada City.

Dry Creek is a major tributary to the Lower Yuba River and enters the river from the north at Hammon Grove County Park. Upper Dry Creek is impounded by Earl Collins Reservoir, operated by the Browns Valley Irrigation District. Dry Creek is listed as critical habitat for Central Valley spring-run Chinook salmon and steelhead trout.

Twelve miles from the confluence with the Feather River, Daguerre Point Dam serves as a point of diversion to irrigators to the north and south of the Yuba. At roughly 20 feet tall, Daguerre has been identified by federal, state, and local agencies as an impediment to fish passage, particularly salmon and steelhead and, as such, affects the species diversity of the entire Upper Yuba.[23]

Bear River Watershed

The 75-mile-long Bear River originates at about 5,000 feet elevation, roughly 20 miles west of the crest of the Sierra Nevada in northern Placer County, just southwest of Spaulding Lake. Its general course through the Plan area is southwest and west to the Feather River.

[22] Upper Yuba River Studies Program Study Team, Upper Yuba River Watershed Chinook Salmon and Steelhead Habitat Assessment (2006).
[23] Ibid.

The Bear River is a major tributary of the Feather River. The drainage basin covers approximately 240 square miles with elevations ranging from more than 5,800 feet. The upper portions of the Bear River watershed are developed in steep to very steep topography.

Flow in the Bear River is regulated by two dams. The dam impounding Camp Far West Reservoir is located approximately 16.5 miles upstream from the Bear River/Feather River confluence. A smaller unnamed dam is located about 1.2 miles downstream of Camp Far West Dam. This dam operates as a diversion structure for irrigation canals located on the north and south sides of the Bear River.

The Bear River watershed is heavily managed for water conveyance for consumption and energy generation from the Upper Yuba, Upper American, and from its own headwaters and tributaries into the Middle and Lower Bear, Lower American, and the associated foothill creek-ravine region.[24]

Feather River Watershed

The Feather River watershed is located north of the Yuba watershed, on the eastern side of the Sacramento Valley, generally north and east from Marysville and Yuba City. Some of the lower Feather River watershed is included in the Plan area. The Feather River flows for 200 miles from an elevation of nearly 10,000 feet in the Sierra Nevada to an elevation of less than 100 feet. As the Feather River flows west onto the Sacramento Valley floor, it turns south and is joined by Honcut Creek (described below), the Yuba River, and the Bear River prior to joining the Sacramento River near Verona. Between Honcut Creek and the Bear River, the Feather River is the western boundary of Yuba County.

The Lower Feather River from Lake Oroville Dam to the confluence with the Sacramento River is a 303(d)-listed water body for chlorpyrifos, Group A pesticides, mercury, PCBs (polychlorinated biphenyls) and other unknown toxicity. Simmerly Slough in the Lower Feather River watershed is a listed water body for unknown toxicity (see **Table 8-1**).

Honcut Creek Watershed

The Honcut Creek watershed, located above the Town of Honcut, is the largest natural tributary to the Lower Feather River, and produces about 60,000 af/yr of runoff. There are no major reservoirs on Honcut Creek, but there are a number of riparian diversions. Honcut Creek is a 303(d)-listed water body for dissolved oxygen (see **Table 8-1**).

6.6.3.1 National and State Wild and Scenic Rivers

It is the mandated responsibility for all federal agencies to identify potential additions to the National Wild and Scenic Rivers Systems. Agencies assess eligibility through their inventory and planning processes and then manage eligible segments accordingly. The Tahoe National Forest (TNF) recommended Wild and Scenic designations for river segments shown in **Table 6-5**. Congress will determine whether to designate these recommended rivers to be included in the National Wild and Scenic Rivers System.

Thirty-nine miles of the South Yuba River (between Lake Spaulding and Englebright Reservoir) is a Designated California Wild and Scenic River and a federally recommended Wild and Scenic River. It is

[24] Yardas and Eberhart. Environmental Defense, Western Resources Program by David Yardas (Consulting Analyst) and Allen Eberhardt (2005). http://bearriver.us/index.php.

used heavily for recreational purposes. Deer Creek is also listed as a Special California Wild and Scenic River because it supports one of the few remaining viable populations of wild spring-run Chinook salmon in the Sacramento-San Joaquin River system.

Table 6-5. Eligible Rivers for the National Wild and Scenic Rivers System

Watershed	Reach	Eligibility Class	Status	Land Management Agency
Yuba	Big Granite Creek	Wild		TNF
	Canyon Creek	Scenic	Recommended	TNF, Plumas National Forest
	Lower South Yuba River	Recreation/Scenic	Recommended	TNF
	North Yuba River	Recreation/Scenic	Recommended	TNF

6.6.4 Vegetation Communities

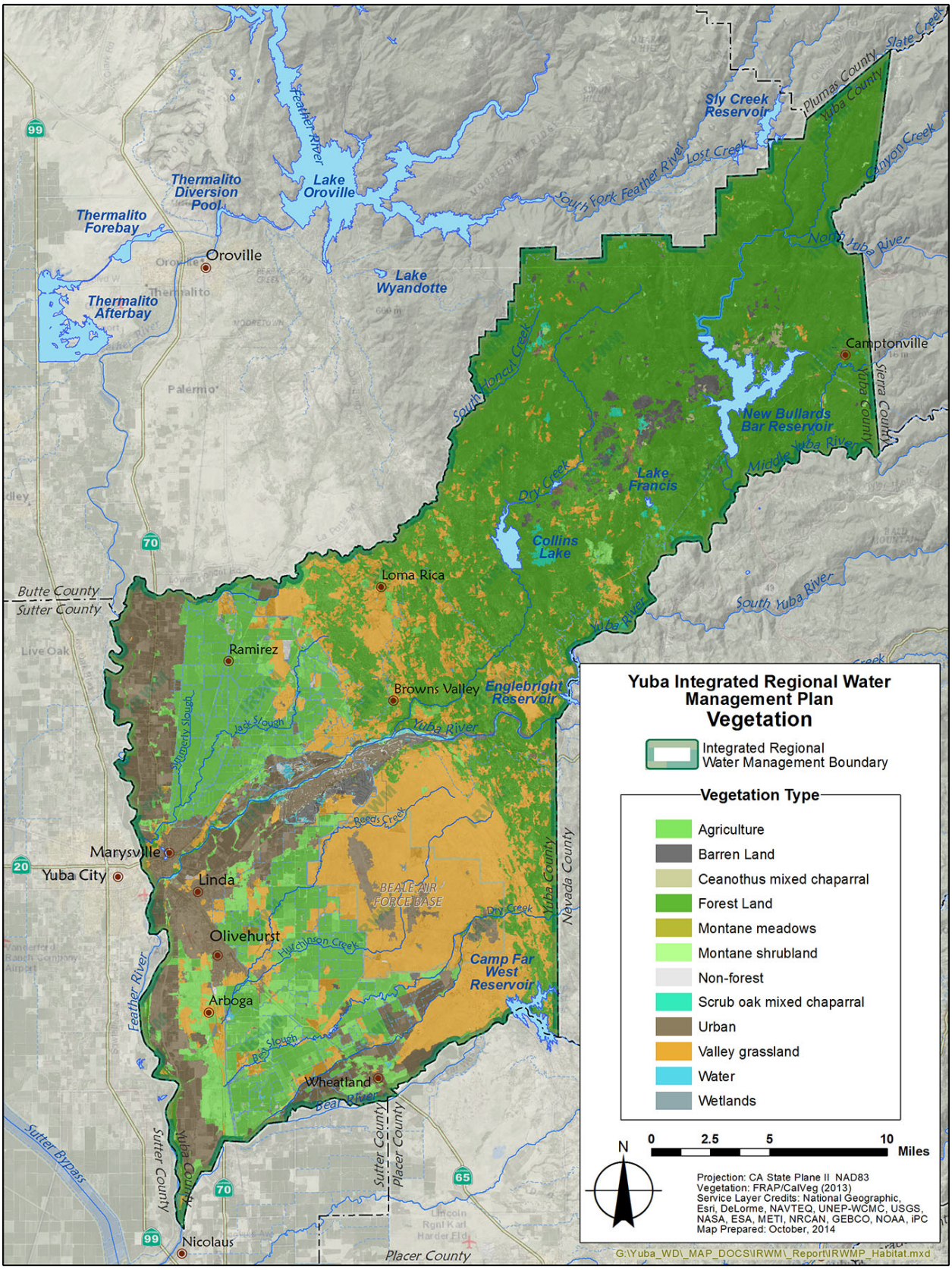
The Yuba County IRWMP region supports a wide variety of vegetation communities and a broad spectrum of environmental conditions, such as elevation, slope, aspect, soils, and precipitation. This relatively small region includes riparian forest, California prairie, blue oak-woodland, Sierran yellow pine forest, Sierran montane forest, and vernal pools. Natural habitats in the region also include riparian woodland, Great Valley oak riparian forest, Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, chaparral, foothill woodland, pine-oak woodland, westside ponderosa pine forest, Darlingtonia seeps, and northern hardpan vernal pool. Many of these natural habitats have been greatly modified by human development. The above-listed native vegetation associations support a variety of wildlife communities.

The most common heavily modified landscapes include non-native grasslands, agricultural land, mid-elevation conifer plantations, and urban or developed land. Most of these cover types are in the western part of the region. Impacts to plant populations have come largely from settlement, grazing, conifer plantation, and fire suppression. The percentages of vegetation types/habitats are presented below in **Table 6-6** and depicted in **Figure 6-7**. While riparian plant communities often contain a high percentage of the most rare and unique plant species, several habitat types with these qualities—including the foothill woodland and chaparral communities—have been particularly damaged and fragmented by changes in agriculture and settlement. Invasion of non-native plant species is pervasive throughout the watershed and is associated with livestock grazing and settlement patterns.[25]

[25] Center for Water Resources, UC Davis, Sierra Nevada Ecosystem Project (1996).

Table 6-6. Vegetation and Land Cover		
Vegetation/Land Cover	**Acres**	**Percent**
Forest Land	186,359.3	45.24%
Valley grassland	82,477.5	20.02%
Agriculture	69,054.9	16.76%
Urban	52,170.4	12.67%
Water	8,915.1	2.16%
Barren land	6,970.1	1.69%
Non-forest	1,978.6	0.48%
Scrub oak mixed chaparral	1,727.7	0.42%
Montane shrubland	1,145.7	0.28%
Wetlands	596.9	0.14%
Ceanothus mixed chaparral	512.4	0.12%
Montane meadows	11.8	0.00%
Grand Total	**411,920.4**	**100.00%**

Figure 6-7


Yuba Integrated Regional Water Management Plan
Vegetation
Integrated Regional Water Management Boundary
Vegetation Type
Agriculture
Barren Land
Ceanothus mixed chaparral
Forest Land
Montane meadows
Montane shrubland
Non-forest
Scrub oak mixed chaparral
Urban
Valley grassland
Water
Wetlands
0 2.5 5 10 Miles
N
Projection: CA State Plane II NAD83
Vegetation: FRAP/CalVeg (2013)
Service Layer Credits: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC
Map Prepared: October, 2014
G:\Yuba_WD_MAP_DOCS\IRWM_Report\IRWMP_Habitat.mxd
Thermalito Diversion Pool
Thermalito Forebay
Thermalito Afterbay
Lake Oroville
Feather River
Oroville
Lake Wyandotte
Sly Creek Reservoir
South Fork Feather River
Lost Creek
Plumas County
Yuba County
Slate Creek
Canyon Creek
North Yuba River
Camptonville
Sierra County
New Bullards Bar Reservoir
Middle Yuba River
Lake Francis
Dry Creek
Collins Lake
South Yuba River
Loma Rica
Butte County
Sutter County
Ramirez
Browns Valley
Englebright Reservoir
Yuba River
Marysville
Yuba City
Linda
Olivehurst
Arboga
Wheatland
Bear River
Nicolaus
Sutter Bypass
Sutter County
Placer County
Nevada County
BEALE AIR FORCE BASE
Camp Far West Reservoir
Reeds Creek
Hutchinson Creek
Dry Creek
Ditch Slough
Jack Slough
Honcut Slough
Live Oak
Palermo
Lincoln Rgnl Karl Harder Fld

Catastrophic Wildfire

Historically, fire played an important role in maintaining diverse landscapes in the foothill region. Accumulated fuels resulting from fire suppression, land management practices including conifer plantation, and drying of the climate have increased the risk of catastrophic fire within the region. This issue is discussed in further detail in Chapter 11 *Climate Change.*

6.6.5 Wildlife and Habitat

Wildlife reported in the Plan area are typical of transitional habitats ranging from the Central Valley to those found on the western slope of the Sierra Nevada.

Species of Special Concern

The most important identified cause of the decline of Sierra vertebrates is the loss of habitat, especially foothill and riparian habitats and late successional forests. In the Sierra, 82 terrestrial vertebrate species are considered dependent upon riparian (including wet meadow or lakeshore) habitat; 20 of these are considered at risk. Bird species in the Sierra region already and will continue to experience habitat displacement due to climate variation.

California species of concern that might also be climate sensitive due to their respective dependence on wetland or riparian habitat include vernal pool fairy shrimp, bald eagle, California red-legged frog, bank swallow, and California black rail. Federally listed endangered and threatened species include vernal pool fairy shrimp (threatened), vernal pool tadpole shrimp (endangered), giant garter snake (threatened), California red-legged frog (endangered), western yellow-billed cuckoo (candidate for federal listing), and Valley elderberry long beetle (threatened).

Critical Habitat

The Plan area includes critical habitat for vernal pool tadpole and fairy shrimp and California red-legged frog. The Main Stem and North Fork Yuba below Englebright Reservoir are designated Critical Habitat for steelhead and salmon as well.[26] The important habitats within the Yuba County IRWM region are not limited to those listed in the California Natural Diversity Database (CNDDB). The number of species actually declining in the foothill zone of the Sierra Nevada is undoubtedly far greater because substantial critical habitat has been converted to urban use. As a result of habitat conversion, several species of both plants and animals have either been extirpated from the valley as well, or their populations have declined significantly.

Non-native Species

Terrestrial plant communities are threatened by the establishment and spread of non-native, invasive species. Species such as yellow star thistle, spotted knapweed, invasive brooms (Scotch, Spanish, and French), and Himalayan blackberry are pervasive in most of the lower elevation watersheds.

Aquatic invasive species include water hyacinth and hydrilla, bullfrog, New Zealand mudsnail, rock snot, giant reed, perennial pepperweed, parrotfeather, Eurasian watermilfoil, and Brazilian waterweed.[27]

[26] CNDDB Search USFWS Critical Habitat (March 6, 2014).
[27] See yubashed.org and calweed.org.

Additional invasion from quagga mussels and other exotic species is anticipated without extreme vigilance from aquatic managers and the public. Threats from aquatic invasives are particularly insidious because of the interconnections between stream systems, and thus the ability for invasives to spread quickly. See discussion on non-native fish, below.

Waterfowl

The California Central Valley is the most important waterfowl wintering area in the Pacific Flyway, supporting 60 percent of the flyway's ducks and geese. A substantially lower amount of wetlands and vernal pools remains in the lowland parts of the Plan area as compared to historic wetlands. As a result of this loss, many waterfowl species have become highly dependent on rice fields for nesting during spring and summer and for food during winter. Yuba County's thousands of acres of rice lands contribute significant habitat to birds and other wildlife. The USFWS is implementing a Central Valley Wildlife Management Area that encompasses Tehama, Butte, Glenn, Colusa, Yuba, Sutter, Placer, Yolo, Solano, Contra Costa, and San Joaquin Counties. The purpose of the acquisition and management program is to preserve important remaining wetland habitat for migratory waterfowl and other wetland dependent wildlife and plants.

6.6.6 Yuba River Fisheries Resources

The major rivers and streams in the region historically supported diverse assemblages of native fish that varied with elevation. In general, anadromous fish populations (Chinook salmon, steelhead trout, lamprey, and green sturgeon) are nearly extinct from Sierra rivers due to dams, impoundments, and degraded stream conditions.[28] The Lower Yuba River may be an exception to this general condition. However, habitat degradation dating back to hydraulic mining activities has severely altered riparian and aquatic habitats in many river reaches, including those of the Lower Yuba River. Rivers, streams, and reservoirs of the area currently support several recreational fisheries of importance.

Species of primary management concern include:

- recreationally or commercially important (rainbow trout, fall-run Chinook salmon, steelhead, American shad, and striped bass);
- federal- and/or state-listed species: spring-run Chinook salmon, steelhead, and green sturgeon; and
- species proposed for federal or state listing within the area, and state Species of Special Concern (late fall-run Chinook salmon, green sturgeon, hardhead, river lamprey, and Sacramento perch).

The extensive fisheries and aquatic ecosystems within the Plan area are described in various documents, including studies conducted by hydropower project operators for relicensing with FERC.

Dams and impoundments block fish passage to and from the Upper Yuba River watershed and have substantially altered the habitat characteristics of certain river reaches. For example, on the North Fork of the Yuba River, Chinook salmon and steelhead were once known to access waterways as far east as Sierra City.[29] Before the original Bullards Bar Dam was built on the North Yuba River in 1904, Englebright Dam, near the valley floor, halted fish migrations to other portions of the Upper Yuba River watershed in

[28] Center for Water Resources, UC Davis, Sierra Nevada Ecosystem Project (1996).
[29] Ibid.

1941.[30] Conversely, while dams have blocked migration routes for some species, reservoirs can provide more consistently cool temperatures throughout the season to downstream reaches, benefiting many cold-water species such as those in the Lower Yuba River.[31] Also, reservoirs can provide good habitat for certain recreational fisheries such as rainbow trout, brown trout, Mackinaw trout, and various species of bass.[32]

Native fish species found in the Upper Yuba watershed include the following:

- California roach (*Lavinia symmetricus*)
- Hardhead (*Mylopharodon conocephalus*)
- Sacramento pikeminnow (*Ptychocheilus grandis*)
- Sacramento sucker (*Catostomus occidentalis*)
- Rainbow trout (*Oncorhynchus mykiss)*

As noted in YCWA's Technical Memorandum on Fish Populations Upstream of Englebright Reservoir, rainbow trout are the most abundant fish in reaches with suitably cold water temperatures, but pikeminnow and sucker dominate in warmer reaches, typically located downstream.

Non-native fishes are also present in the upper watershed and may place competitive pressures on native species. Non-native fish species found in the watersheds include:

- Green sunfish (*Lepomis cyanellus*)
- Brown trout (*Salmo trutta*)
- Smallmouth bass (*Micropterus dolomieu*)
- Brown bullhead (*Ameiurus nebulosus*)
- Kokanee salmon (*Oncorhynchus nerka*)
- Carp (*Cyprinus carpio*)
- Red eye bass (*Micropterus coosae*)

Fishery resources of the Lower Yuba River are described in two of the Technical Memoranda listed above, as well as in the Lower Yuba River Accord EIS/EIR and the Draft Interim Report of the River Management Team.[33]

Many species rely on the Lower Yuba River for spawning, rearing, and migration. Other species (e.g., green sturgeon) may only exist in the river for periods of holding or rearing. YCWA's Summary of Technical Memorandum 3-9 summarizes the fish species documented in the Lower Yuba River:

> YCWA identified and reviewed 54 references reporting on existing and ongoing fish studies in the downstream of Englebright Dam and found reliable, documented, and reported occurrences of 42 fish species and anecdotal unverified reports of three species, for a total of 45 fish species. Twenty-two species (49% of the total fish species), nine of which are anadromous, are native to California. Twenty-three species (51% of the total fish species), two of which are anadromous, are introduced to California. None of the fish species are catadromous, and none are reported to only occur in the Yuba River basin.

[30] Yoshiyama, et al. Historic and present distribution of chinook salmon in the central valley drainages of California (2001), California Department of Fish and Game.
[31] The PCWA FERC relicensing work included an examination of temperature fluctuations on the Middle Fork of the American River, including the Rubicon. This information may be viewed in the maps section of PCWA 2010b.
[32] PCWA 2011b
[33] Bureau of Reclamation, Lower Yuba River Accord (2007), EIR/EIS.

Among the fish species documented to occur in the Yuba River downstream of Englebright Dam were three species listed under the federal Endangered Species Act (ESA): 1) Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*) Evolutionary Significant Unit (ESU); 2) Central Valley steelhead (*O. mykiss*) Distinct Population Segment (DPS); and 3) Southern Distinct Population Segment of North American green sturgeon (*Acipenser medirostris*). Spring-run Chinook salmon is also listed under the California ESA.

Six fish species listed as California Species of Special Concern (CSC) were also documented in the Yuba River downstream of Englebright Dam, including: 1) pink salmon (*O. gorbuscha*); 2) chum salmon (*O. keta*) (both native anadromous fish, but extremely rare in Central Valley streams); 3) river lamprey (*Lampetra ayresii*); 4) hardhead (*Mylopharodon conocephalus*); 5) California roach (*Hesperoleucus symmetricus*); and 6) North American green sturgeon, which is also listed under the ESA. Sacramento splittail (*Pogonichthys macrolepidotus*), another species of special concern, was reported to occur in the Yuba River downstream of Englebright Dam (UC Davis 2012); however YCWA could not find any verified observations of splittail among the referenced studies and reports.

Relative abundance, temporal and spatial distribution, and habitat utilization of the reported fish species were derived primarily from two studies conducted between 1986 and 1991, and several ongoing studies that are being conducted by the Yuba River Accord River Management Team (RMT). Chinook salmon was the most abundant species reported among the various studies. During their spawning and rearing periods (September through June), spring-run and fall-run Chinook salmon dominated the numbers of fish observed throughout the Yuba River downstream of Englebright Dam. They accounted for as much as 95 percent of the fish observed in the Rotary Screw Traps (RST) surveys, the snorkel and electrofishing surveys, and the VAKI Riverwatcher surveys.

Chinook salmon and rainbow or steelhead trout populations are of extremely high importance in the Lower Yuba River, and have been the focus of the Yuba Accord's Fisheries Agreement, as well as a focused Monitoring and Evaluation Program. In 2013, the RMT released a Draft Interim Report on its Monitoring and Evaluation Program. Results confirmed that the Yuba Accord has succeeded in keeping water temperatures throughout most of the Lower Yuba River within preferred temperature tolerances for these salmonid species. The purpose of the Monitoring and Evaluation Program is to determine if the Yuba Accord is fully protective of these populations and their habitat. While the Interim Report includes much information to support an affirmative conclusion, additional monitoring, evaluation, and analysis was recommended to address the following questions or issues:

- abundance and productivity of steelhead;
- additional investigations related to habitat suitability and carrying capacity for juvenile salmonids;
- additional considerations regarding interactions between Yuba River anadromous salmonid populations and those of the Feather River, including hatchery fish;
- further evaluate contribution of the Lower Yuba River populations to the structure of the larger Sacramento Valley fish populations; and
- investigate potential actions to enhance or restore habitat or improve population status.

Data and presentations by the RMT can be found at www.yubaaccordrmt.com/Presentations/Forms/.

Some actions and planning processes have already begun to improve habitat in the Lower Yuba River for the benefit of anadromous fish populations. Funded primarily by the USFWS's Anadromous Fish Restoration Program (AFRP), South Yuba River Citizens League (SYRCL) planted 6,800 riparian trees on Hammon Bar, located four miles downstream of the Highway 20 bridge at Parks Bar. SYRCL conducted analysis regarding riparian habitat in the Lower Yuba River as part of their project (yubariver.org/ restoration). Additionally, AFRP has funded the development of plans for improving habitat in the reach immediately below Englebright Dam where spawning gravels are severely limited. The USACE has embarked on a program of adding gravel to the river below Englebright Dam to enhance spawning habitat and placing large wood in the river to enhance rearing habitat.

Another consideration for healthy fisheries is the system bioenergetics, or the circulation of energy in the system. This can be measured, in part, by the availability of food for fish, of which macro-invertebrates play a large role. Studies of macroinvertebrate populations have been conducted by YCWA and Nevada Irrigation District as part of FERC relicensing.

Following is a list of pertinent documents:

- YCWA (2012), Stream Fish Populations Upstream of Englebright Reservoir. Technical Memo 3-8. Yuba River Development Project.
- YCWA (2012), Non-ESA Fish Populations Below Englebright Dam. Technical Memo 3-9. Yuba River Development Project.
- YCWA (2013), CESA-ESA Listed Fish Populations Below Englebright Dam. Technical Memo 7-8. Yuba River Development Project.
- YCWA (2014), Riparian Habitat Upstream of Englebright Reservoir. Technical Memo 6-1. Yuba River Development Project.
- YCWA (2013), Riparian Habitat Below Englebright Dam. Technical Memo 6-2. Yuba River Development Project.
- YCWA (2013), Aquatic Macroinvertebrates Upstream of Englebright Reservoir. Technical Memo 3-1. Yuba River Development Project.
- YCWA (2013), Aquatic Macroinvertebrates Below Englebright Dam. Technical Memo 3-2. Yuba River Development Project.

6.6.6.1 Feather River Fisheries Resources

The Feather River watershed has an area of 5,900 square miles, with numerous tributaries, the largest of which is the Yuba River. Downstream of Oroville Dam, the water is diverted in several directions: the Thermalito Complex, the Feather River Fish Hatchery, and the Low Flow Channel. The sources combine below the Thermalito Afterbay, creating the High Flow Channel. The Low Flow Channel is highly regulated, with flows of approximately 600 cubic feet per second for the majority of the year. The Low Flow Channel also contains the majority of the anadromous salmonid spawning habitat.

6.6.6.2 Bear River Fisheries Resources

The Lower Bear River, below Camp Far West Dam, was formerly designated as critical Chinook salmon habitat by the National Marine Fisheries Service (NMFS) for both spring-run and fall-run Chinook salmon. However, the US District Court of Columbia approved a consent decree withdrawing this designation in 2002. It is not known whether Chinook salmon or steelhead trout spawn in the Lower Bear River. It is likely,

however, that the Bear River provides valuable rearing habitat for out-migrating salmon and steelhead, including those migrating from spawning areas in the Yuba and Feather Rivers.[34]

6.6.6.3 Special-Status Species

Plants and Wildlife

A total of 22 occurrences of federal- and state-listed plant species and 25 occurrences of wildlife species were identified in the CNDDB search conducted on March 18, 2014. Information regarding species and habitats of special concern within the Plan area is supplied by CDFW and USFWS and shown in **Appendices 6-1** (CNDDB maps) and **6-2** (CNDDB list).

Fisheries

CDFW, USFWS, and NMFS identified Central Valley fall-run and spring-run Chinook salmon and steelhead as the primary fish species of concern in the Lower Yuba River. Fall-run Chinook salmon are the most abundant anadromous fish in the Lower Yuba River and support significant sport and commercial fisheries. Fall-run Chinook salmon are designated as a species of concern under the federal ESA and a Species of Special Concern under the California ESA (CESA). Spring-run Chinook salmon are listed as a threatened species under both the federal ESA and CESA. Steelhead trout are listed as threatened under the federal ESA. Additionally, CDFW is concerned with protecting American shad, and USFWS has stated concerns regarding green sturgeon in the Lower Yuba River. Effective June 2006, NMFS listed the Southern Distinct Population Segment of the North American green sturgeon as a threatened species. In the project study area, the only known spawning habitat for green sturgeon is on the Sacramento River. Chinook salmon, steelhead, and American shad populations in the Lower Yuba River depend on adequate flows downstream of Englebright and Daguerre Point Dams to provide habitat for adult attraction and passage, spawning, egg incubation, juvenile rearing, and emigration. Green sturgeon is of concern below Daguerre Point Dam. Hardhead is a native minnow listed as a Species of Special Concern by CDFW.

As the owner and operator of both Englebright Dam and Daguerre Point Dam on the Yuba River, the USACE has consulted with NMFS as stipulated in Section 7 of the Endangered Species Act. These consultations, and a series of Biological Assessments of the dams' impact on listed fish species, have resulted in Biological Opinions issued in 2002, 2007, 2012, and 2014. The 2012 Biological Opinion concluded that the dams jeopardized the existence of spring-run Chinook, steelhead, and green sturgeon, and required a long list of actions known as reasonable and prudent alternatives. However, the 2014 Biological Opinion was based on a concurrence by NMFS with a new position of USACE that the existence of the dams is a baseline condition, and therefore few activities of the Corps (none concerning Englebright Dam) are subject to alternatives or requirements under the ESA. Currently, the USACE is responsible for maintaining the existing fish ladders at Daguerre Point Dam and has volunteered to operate a program of enhancing habitat below Englebright Dam with additions of gravel and wood.

6.6.6.4 In-stream Flow Requirements on Lower Yuba River

In-stream flow requirements for the Lower Yuba River are prescribed by either the SWRCB-approved Lower Yuba Accord or YCWA's FERC license (#2246). The Yuba Accord and amendments to the FERC license resolved longstanding disputes over minimum streamflows, flow fluctuations, and water temperatures in the Lower Yuba River. Prior to the Accord, the SWRCB's Revised Decision 1644 (RD-1644) was met with controversy.

[34] Reedy, G., SYRCL (September 18, 2014).

YCWA must meet the in-stream flow requirements as measured at two compliance points, the USGS gages at Smartsville and Marysville. Minimum in-stream flow requirements are measured using a five-day running average of average daily streamflows. Specific monthly or semi-monthly flow requirements are meant to meet habitat needs for anadromous fish and vary according to water storage and inflow to New Bullards Bar Reservoir.

Flow fluctuations and reductions in streamflow could cause dewatering of salmonid redds and stranding of fry and juvenile fish. Fluctuations in base flow are changes in flow that occur associated with routine or daily operations of hydroelectric power generation or deliveries to water diverters. Planned flow reductions typically occur over a period of a day or more, such as those associated with changes in in-streamflow requirements, reservoir flood reservation requirements, and deliveries to off-stream diverters, water transfers, downstream salinity intrusion control, or other management purposes. By contrast, management during storm runoff and for flood control operations is not subject to flow fluctuation restrictions.

FERC issued a License Amendment for the Yuba Project (Project No. 2246) on November 22, 2005, imposing a more protective set of flow fluctuation and ramping requirements for the Yuba Project than existed before the Yuba Accord. The new criteria govern YCWA's releases of water from the Narrows II Powerhouse and require YCWA to make reasonable efforts to operate New Bullards Bar and Englebright Reservoirs to avoid flow fluctuations in the Lower Yuba River. Details of the flow fluctuation and ramping requirements are described in the Yuba Project EIR/EIS.

6.7 Likely Climate Change Impacts

Please refer to Chapter 11 *Climate Change* for detailed discussions of climate-related impacts in the Yuba County IRWM Plan Area.

Chapter 7 *Water Supply*

7.0 Introduction

This chapter presents an overview of the water resources setting including the historical and current conditions of water supply. Yuba County's surface and groundwater water resources are extensive and include the North, Middle, and Lower Yuba; portions of the Feather and Bear River systems; and two major groundwater subbasins: North Yuba and South Yuba. The Lower Yuba is characterized by the 24-mile river reach from below Englebright to the confluence with the Feather at Yuba City. Delivery and management of these resources requires extensive infrastructure and continuous maintenance, which present challenges to local water managers, especially disadvantaged communities, in the region.

The water purveyors of the region exercise many senior Area of Origin water rights to meet the needs of local citizens. The Area of Origin laws are a set of legislature enactments that collectively seek to reassure local water rights owners and users that their needs will be protected from impacts of exporting water out of the area of origin.[1]

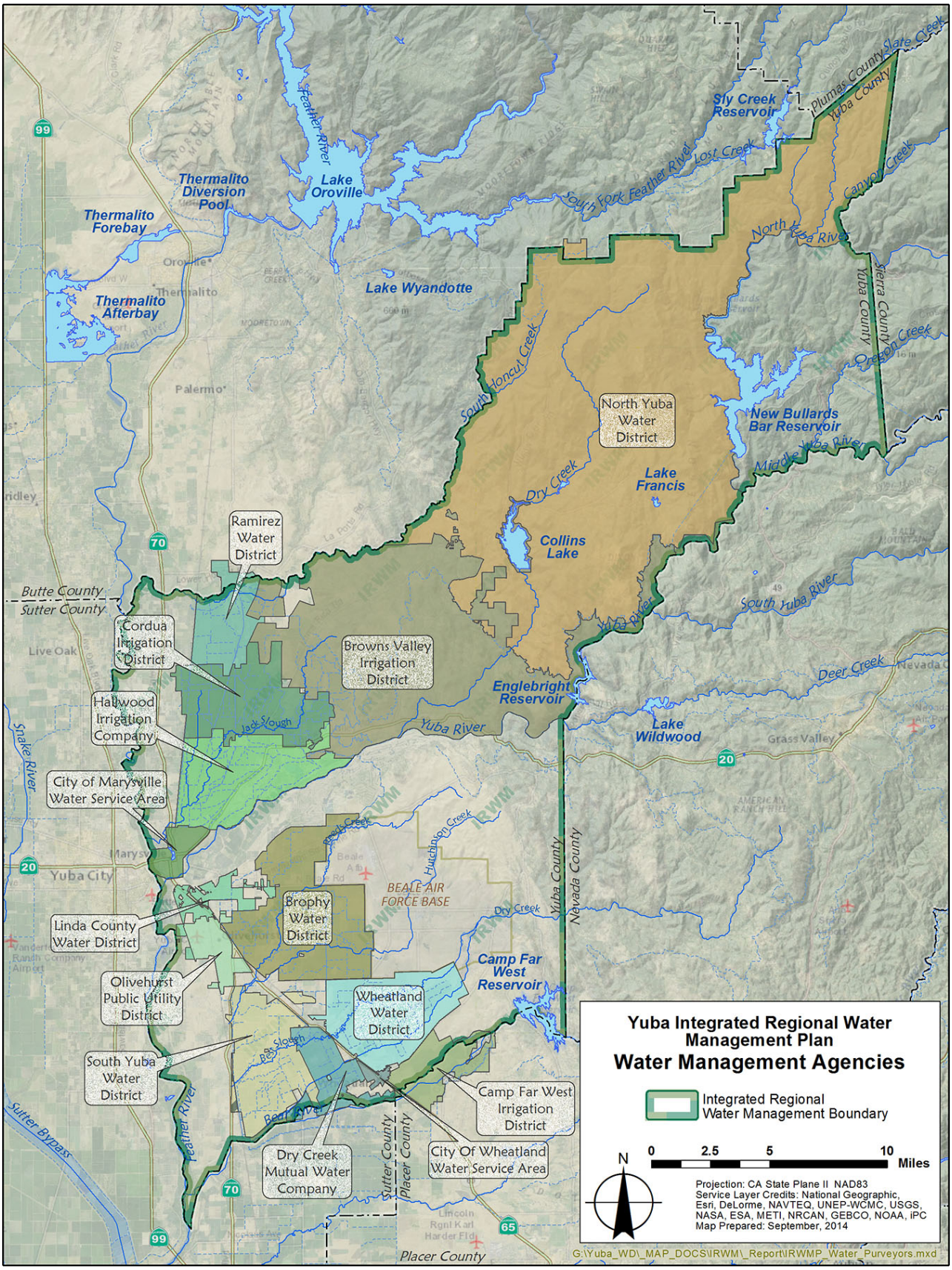
The water purveyors on the valley floor currently use both surface water and groundwater to meet demand. Yuba County Water Agency (YCWA) delivers surface water from the Yuba River to its member units: Cordua Irrigation District, Ramirez Water District, Hallwood Irrigation Company, Browns Valley Irrigation District, Brophy Water District, South Yuba Water District, Dry Creek Mutual Water Company, and Wheatland Water District. The member units use their own water rights or pump groundwater to meet part of their water demands. Rural and domestic water users depend upon the groundwater basin for water supply. Protection of groundwater resources and supplies is an important issue. The municipal water purveyors located on the valley floor rely exclusively on groundwater to meet their needs. The municipal purveyors are California Water Service for the City of Marysville, Linda County Water District (CWD), the City of Wheatland, Olivehurst Public Utilities District (PUD), and Beale Air Force Base (AFB). See **Figure 7-1** for a map of all the water purveyors in the Yuba County IRWMP region.

Foothill communities within the Plan area, such as Camptonville, Brownsville, Challenge, Dobbins, and Oregon House, also use both surface water and groundwater to meet their needs. Surface water sources include the rivers and streams on which in-stream diversions and storage facilities have been constructed with local financing. As a result, local water supplies vary seasonally and year to year, depending on the amount and timing of precipitation and the corresponding significant variability in runoff. Many public and private water systems supply water within the foothills region of the Plan area, with locally developed surface water accounting for approximately 85 to 90 percent of the local consumptive use. The remainder of the water is provided from federal water facilities, individual groundwater wells, small private surface storage, locally developed imports from adjacent hydrologic regions, and reclaimed wastewater.

As explained by the Department of Water Resources' (DWR's) online Groundwater Information Center, although surface water and groundwater appear to be two distinct sources of water, they are not. Surface water and groundwater are connected physically in the hydrologic cycle.[2] Continued sustainability of local water supplies and other future benefits of groundwater substitution depend upon

[1] Wilson, N.D. California's Area of Origin Laws (October 8, 2013). http://mountaincountieswater.com/wp-content/uploads/2012/06/Craig-Wilson-Delta-Watermaster.pdf
[2] Department of Water Resources, Groundwater Information Center, http://www.water.ca.gov/groundwater/.

Figure 7-1


Yuba Integrated Regional Water Management Plan
Water Management Agencies
Integrated Regional Water Management Boundary
0 2.5 5 10 Miles
N
Projection: CA State Plane II NAD83
Service Layer Credits: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC
Map Prepared: September, 2014
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Lake Oroville
Thermalito Diversion Pool
Thermalito Forebay
Thermalito Afterbay
Lake Wyandotte
Sly Creek Reservoir
Lake Francis
Collins Lake
New Bullards Bar Reservoir
Englebright Reservoir
Lake Wildwood
Camp Far West Reservoir
Ramirez Water District
Cordua Irrigation District
Hallwood Irrigation Company
City of Marysville Water Service Area
Linda County Water District
Olivehurst Public Utility District
South Yuba Water District
Browns Valley Irrigation District
Brophy Water District
Wheatland Water District
North Yuba Water District
Camp Far West Irrigation District
City Of Wheatland Water Service Area
Dry Creek Mutual Water Company
Butte County
Sutter County
Yuba County
Nevada County
Plumas County
Sierra County
Placer County
Yuba City
Live Oak
Palermo
Oroville
Grass Valley
BEALE AIR FORCE BASE
Feather River
Yuba River
South Fork Feather River
North Yuba River
Middle Yuba River
South Yuba River
Dry Creek
Deer Creek
Oregon Creek
Canyon Creek
Slate Creek
Lost Creek
South Honcut Creek
Hutchinson Creek
Jack Slough
Snake River
Sutter Bypass
Bear River
Bear Slough
99
70
20
65

recharge of the underlying aquifer with surface water from the Yuba River. This recharge is achieved through a combination of deep percolation of applied irrigation water on the farmed lands, along with seepage from the YCWA and member unit distribution and drainage system. As a result, strategies of YCWA and member units to conserve water are focused on reduction of losses to spillage and tailwater that leave the YCWA member unit service areas. Extensive recovery and reuse of spillage and tailwater is practiced within the member unit service areas, and future efforts aim to both reduce and recover additional losses that would otherwise leave the area. The net effect of this conservation is to decrease Yuba River diversions and groundwater pumping, enhancing local supply and increasing the amount of water available for transfer.[3]

Effective management requires consideration of both surface and groundwater sources as one resource. With that in mind, more understanding and protection of groundwater, especially from contamination and overuse, is needed to increase the overall water supply. Monitoring and evaluation must be continued to gain the understanding needed so that future groundwater issues are not overlooked or misunderstood.

7.1 Surface Water Supplies

The following sections describe the surface water supplies and storage facilities for the region.

7.1.1 Yuba River

The Yuba River is centrally located within Yuba County and provides the primary surface water source to both the valley and foothill regions. The Yuba River basin drains approximately 1,339 square miles of the western Sierra Nevada slope, including portions of Sierra, Placer, Yuba, and Nevada Counties. The Yuba River is a tributary of the Feather River, which, in turn, is a tributary of the Sacramento River. The average annual unimpaired flow of the Yuba River at Smartsville is 2.45 million acre-feet (maf); however, a portion of this water is diverted from the watershed and is not available to the Lower Yuba River. The annual unimpaired flow has ranged from a high of 4,925,000 acre-feet (af) in 1986 to a low of 370,000 af in 1977. The average surface water supply use in the region is about 304,000 af, with plans for expansion to 345,000 af.

7.1.1.1 Yuba County Water Agency Water Rights

YCWA is a major water rights holder on the Yuba River. YCWA diverts water for consumptive uses under Permits 15026, 15027, and 15030. YCWA's permits authorize direct diversion up to a total rate of 1,593 cubic feet per second (cfs) from the Lower Yuba River from September 1 to June 30 for irrigation and other uses, and up to 1,250,000 af from October 1 to June 30 to storage in New Bullards Bar Reservoir.

Various water districts, irrigation districts, and mutual water companies have contracts with YCWA for delivery of water. Some of the parties that receive water from YCWA also have their own appropriative rights for diversion of water from the Yuba River, including Browns Valley Irrigation District, Cordua Irrigation District, and Hallwood Irrigation Company. Other agencies and districts providing surface water for irrigation in Yuba County include the North Yuba Water District (from the south of the Feather River), Camp Far West Irrigation District (from the Bear River), and Plumas Mutual Water Company (from the Lower Feather River).

[3] Yuba County Water Agency, Agricultural Water Management Plan (December 2012).

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

7.1.2 Other Rivers that Contribute to Water Supply

Other large rivers that contribute surface water supplies to Yuba County include the Feather River, Honcut Creek, and the Bear River.

7.1.2.1 Feather River and Lake Oroville

The Feather River watershed is located on the eastern side of the Sacramento Valley, generally north and east from Marysville and Yuba City. The Feather River watershed is located north of the Yuba River watershed in the Sierra Nevada. The drainage of the watershed at Oroville Dam is 3,607 square miles. The Feather River flows for 200 miles from an elevation of nearly 10,000 feet in the Sierra Nevada to an elevation of less than 100 feet near its confluence with the Sacramento River. As the Feather River flows west onto the Sacramento Valley floor, it turns south and is joined by Honcut Creek, the Yuba River, and the Bear River prior to joining the Sacramento River near Verona. Between Honcut Creek and the Bear River, the Feather River is the western boundary of Yuba County.

Oroville Dam and Reservoir, a key feature of the State Water Project (SWP), was completed in 1968. It has capacity for 3,537,000 af, of which up to 750,000 af are dedicated to flood control between October 15 and March 31. The Feather River watershed above Oroville Dam totals about 3,600 square miles (**Figure 6-2**). Precipitation falls in the form of rain and snow. Oroville Dam is owned and operated by the DWR as part of the SWP. Unimpaired flows range from 1,000,000 af per year to 9,400,000 af per year (af/yr) and average about 3,800,000 af/yr. The maximum objective flood release is 150,000 cfs. The SWP has inundation rights to flood portions of western Yuba County within Reclamation District 10 located north of the City of Marysville upstream of the confluence of the Feather and Yuba Rivers.

The North Yuba Water District has an existing agreement with the South Feather Water and Power Agency for a firm supply of 3,700 af/yr and surplus water when available from the South Fork Feather River Project.

7.1.2.2 Honcut Creek

The Honcut Creek watershed, above the Town of Honcut, totals about 78 square miles and produces about 60,000 af/yr of runoff, primarily from rainfall. There are no major reservoirs on Honcut Creek, but there are a number of riparian diversions.

7.1.2.3 Bear River

The Bear River is the second largest tributary to the Feather River (the Yuba River is the largest tributary). The Bear River drainage basin area totals about 550 square miles and joins the Feather River about 15 miles south of the City of Marysville. The watershed above Camp Far West Dam totals about 290 square miles (**Figure 6-2**). The Bear River watershed is much smaller and at a lower elevation than the Yuba and Feather Rivers, so most of the precipitation falls in the form of rain. Unimpaired flows range from about 20,000 to 740,000 af/yr and average 272,000 af/yr.

7.1.2.4 Dry Creek

Dry Creek is a tributary to the Yuba River with a drainage basin totaling about 108 square miles. It joins the Lower Yuba River about 15 miles east of the City of Marysville. Dry Creek begins near Frenchtown and flows to the northeast end of Collins Lake. It then flows from the southwest end of Collins Lake to Browns Valley, where it enters the Yuba River in Hammon Grove Park. The total length of Dry Creek is about 29 miles and unimpaired flows average 55,000 af/yr.

7.1.3 Recycled Water

Yuba County stakeholders have identified various opportunities for recycled water as is demonstrated in Chapter 14 *Project Application, Development, and Review*. Currently, the Cities of Wheatland and Olivehurst are proposing recycled water feasibility studies, and YCWA is exploring collaboration with its north area member units to develop a North Area Irrigation Water Reuse Project. Beale AFB uses secondary-23 disinfected recycled water to irrigate the Base's golf course. The golf course is operated as a restricted access golf course, and historical demand is about 100 million gallons per year.

7.1.4 Return Irrigation Flows

The 2010 Yuba County Water Agency Groundwater Management Plan suggests that runoff and recharge from irrigation may be a significant contributor to overall groundwater, offering over 30 percent of recharge from percolation of applied surface irrigation water. A better understanding of the relationship between primary water demands and return flow volumes/recharge dynamics is needed in order to effectively manage conservation strategies in the Yuba County IRWMP region based on return flows.

7.2 Groundwater Supplies

The following section describes groundwater supplies for the region.

7.2.1 Upper Watershed

While groundwater is critical to the valley region, groundwater in the foothill region is an inadequate and unreliable water supply for large-scale use. The fractured bedrock formations that constitute much of the Sierra Nevada foothills and western slopes of the mountains are poorly suited to contain large quantities of groundwater. Water cannot penetrate the rocks unless there are fractures; where rock fractures are present, small amounts of water can be stored and made available to wells that intersect the fractures. Nevertheless, many rural homes, farms, and ranches throughout the foothills of the region rely on groundwater supplies, with individual wells.

7.2.2 Valley Floor

Groundwater is a critical supply for the Yuba County IRWMP region's valley, including for all five municipal purveyors (Marysville, Olivehurst PUD, Linda CWD, Wheatland, and Beale AFB) that depend exclusively on groundwater for municipal/industrial water supply. The groundwater aquifer underlying the valley floor within Yuba County is divided into two subbasins: North Yuba and South Yuba. These two subbasins encompass approximately 270 square miles and are defined by DWR as follows:

- North Yuba subbasin (groundwater basin number 5-21.60) is bounded on the north by Honcut Creek, the Feather River on the west, on the south by the Yuba River, and on the east by the Sierra Nevada.
- South Yuba subbasin (groundwater basin number 5-21.61) is bounded on the north by the Yuba River, the Feather River on the west, on the south by the Bear River, and on the east by the Sierra Nevada.

These two subbasins are part of the larger Sacramento Valley groundwater basin and are somewhat hydraulically isolated from the rest of the Sacramento basin by the surface streams that surround them. See **Figure 6-2**.

7.2.3 Groundwater Levels

The 2010 YCWA Groundwater Management Plan estimated total freshwater storage in Yuba County's groundwater basin to be 7.5 maf. Wells in the region range from less than 300 feet in the east basin to about 700 feet in the west, with some well depths as much as 900 feet at the Feather River.[4] However, since most wells are screened at less than 300 feet below ground surface, *readily accessible* freshwater is estimated at 4.0 maf.

According to the 2010 YCWA Groundwater Management Plan, groundwater levels along the Feather River in both the North and South Yuba subbasins have been generally stable since at least 1960. Starting in the 1970s, the North Yuba subbasin (Ramirez Water District, Cordua Irrigation District, Hallwood Irrigation Company, and Browns Valley Irrigation District) began showing groundwater level improvements coinciding with surface water deliveries to the Ramirez Water District. Similarly, groundwater elevations recovered from historical overdraft in the central South Yuba subbasin (Brophy Water District, Dry Creek Mutual Water Company, South Yuba Water District, and Wheatland Water District) when surface water deliveries were made there, starting in the 1980s.[5]

Shallow groundwater levels directly influence and are influenced by adjacent streams. When shallow groundwater levels rise, streamflows can be increased; conversely when they lower, stream flows can decrease. When groundwater is near the surface, it can create wetlands and other similar habitat.

7.2.4 Groundwater Flow Direction

Groundwater flows from the eastern boundary of Yuba County toward the western boundary of the county. The hydraulic gradient dips steeply from the Sierra Nevada mountain front, which abuts the eastern boundary of the county and gradually flattens out toward the west, eventually discharging into the Feather River. According to the 2010 YCWA Groundwater Management Plan, spring groundwater flows on average from about 140 feet above mean sea level (msl) in the east to 30 feet above msl in the western part of the county. This pattern of higher groundwater elevations on the east declining to the west is consistent for both the North Yuba subbasin and the South Yuba subbasin, with a few deviations in the South Yuba subbasin due to the moderate cone of depression that exists in the basin's center.[6]

[4] Yuba County Water Agency, Agricultural Water Management Plan (December 2012).
[5] Yuba County Water Agency. Yuba County Water Agency Groundwater Management Plan (2010).
[6] Ibid.

In the North Yuba subbasin, groundwater levels range from about 130 feet above msl at the eastern edge of the basin near the Yuba River to about 50 feet msl near the City of Marysville. Groundwater elevations near the center of the subbasin are at about 70 feet above msl.

In the South Yuba subbasin, groundwater levels range from about 140 feet at the eastern edge of the subbasin near the Yuba River and Beale AFB to about 25 feet above msl at selected locations west of Highway 70. Groundwater elevations near the center of the subbasin are at about 45 feet above msl. Groundwater elevations near the City of Wheatland are at about 50 to 60 feet above msl and decline to about 35 feet above msl to the northwest along Highway 65.

7.2.5 Groundwater Level Trends

Several wells in the North Yuba subbasin have been consistently monitored since the 1960s. In general, the drought of 1977 is the record low for groundwater levels in the basin. The groundwater levels did not fully recover from this drought until 1982. From 1982 to 1991, groundwater levels throughout the basin rose 10 feet on average and up to 20 feet in some areas. This rise in groundwater elevation was likely due to delivery of surface water for irrigation from the Yuba Project. Seasonal variations in groundwater elevation typically range 10 feet from spring to fall.

Historically, groundwater levels have exhibited a well-developed regional cone of depression beneath the South Yuba subbasin since as early as the 1940s. The cone of depression starts on the western side of Beale AFB and continues into the central region (west of Beale AFB) of the South Yuba subbasin. Water levels in the center of the cone of depression were just below sea level during the 1960s. Nearly all groundwater levels were well below adjacent river levels on the Bear, Feather, and Yuba Rivers at that time. Groundwater conditions in 1984 reflected a continued reliance on groundwater pumping in the South Yuba basin. Water levels in the center of the South Yuba cone of depression had fallen to 30 feet below sea level. The water level contours adjacent to the Bear and Yuba Rivers indicated a large gradient and seepage from the rivers. By 1990, water levels in the South Yuba basin cone of depression rose to 10 feet above sea level. The rise in water levels was due to increasing surface water irrigation supplies and reduced groundwater pumping. Groundwater levels have largely recovered from historical overdraft, except in the Wheatland area, because of YCWA's surface water project (i.e., Brophy Canal).[7]

As discussed further in Section 7.6 below, groundwater supplies in the Yuba County IRWMP region lack resiliency after droughts based on past events, but they are remaining more stable with interbasin water transfers[8] and the introduction of surface water supplies to agriculture.[9] Ultimately, this could result in increased vulnerability to climate change if the Yuba basin is overdrawn due to out-of-basin transfers or diversions, climate drying, or shifting state policies that could tax this finite supply.

7.2.6 Groundwater Recharge and Transfers

As discussed below, the greatest water demand in the region by far (80 percent or more) is for agricultural use, primarily for crop irrigation. The 2010 YCWA Groundwater Management Plan suggests that runoff and recharge from irrigation may be a significant contributor to overall groundwater, offering

[7] Yuba County Water Agency, Groundwater Management Plan Update to Board (September 12, 2006).
[8] Yuba County Water Agency. Yuba County Water Agency Groundwater Management Plan (2010).
[9] Ibid.

over 30 percent of recharge from percolation of applied surface water. About 30 percent of the region's irrigation comes from groundwater pumping, the majority of which occurs south of the Yuba River.[10]

One of the features of the Yuba County IRWMP region's water development strategy has been interbasin transfers of both ground and surface water as a response to water scarcity.[11] This water-management strategy has been encouraged by California law since the 1850s and is an integral part of meeting the needs of the Yuba County IRWMP region and providing water for all beneficial uses. Interbasin water projects are, in some cases, subject to the continuing jurisdiction of the State Water Resources Control Board (SWRCB) because the rights involved are post-1914 appropriative rights. Many (if not most) of the surface water projects seek to capture flows during the winter season and use them to meet demand from municipal/industrial users, agricultural users, and the environment for water during the summer.

Groundwater substitution transfers have been completed in six relatively dry years since 1991; during such a year groundwater demand can double and is then generally recharged within two to three years after pumping ends. Most recently, in 2009, during the second year of groundwater substitution transfers and the third year of a relatively dry cycle, irrigators in Reclamation District 10, located along the Feather River in the North subbasin, experienced lower groundwater discharge rates than the previous six years from irrigation wells. Reduced groundwater elevations were attributed to dry conditions, additional pumping within Reclamation District 10 due to dry conditions, and groundwater substitution transfer pumping outside of Reclamation District 10. Additional pumping rates and groundwater level monitoring were initiated to assess and address this problem.

Three areas within the Yuba County IRWMP region involve interbasin water development: North Yuba to the South Fork Feather (via the Slate Creek Tunnel), Middle Yuba to South Yuba to Bear River, and North Fork American to Bear River. In addition, the North Yuba Water District has an existing agreement with the South Feather Water and Power Authority for a firm supply of 3,700 af/yr and surplus water when available from the South Fork Feather River Project. This transfer can result in an interbasin transfer from the Feather River watershed to the Yuba watershed.

The movement of water from the North Yuba River to the South Feather River is based on an agreement between the YCWA and the South Feather Water and Power Agency. Water is transported from the North Yuba watershed to the South Fork Feather watershed for use in hydropower generation. Water from Slate Creek, a tributary to the North Yuba, is intercepted by the Slate Creek Diversion Dam, and conveyed via a 2.5-mile tunnel to Sly Creek Reservoir, a tributary to the South Fork Feather River. From 2000 to 2005 an average of 78,000 af/yr of water was transferred.[12]

The movement of water from the Middle Yuba River to the South Yuba River to the Bear River occurs under Federal Energy Regulatory Commission (FERC) #2266 for Nevada Irrigation District's (NID) Yuba Bear Hydroelectric Project. NID is the licensee, owner, and operator, and NID and PG&E coordinate operations in the project. Under the license, approximately 30,000 af/yr of Middle Yuba water is conveyed via the Milton-Bowman Conduit and Bowman-Spaulding Canal to the South Yuba watershed. From Spaulding Lake in the South Yuba watershed, a portion of the original Middle Yuba water flows into the Drum Canal and eventually the Bear River, and another portion flows into the South Yuba Canal and

[10] Yuba County Water Agency. Yuba County Water Agency Groundwater Management Plan (2010).
[11] Department of Water Resources, California Water Plan (2009).
[12] United States Geological Survey (2006a). USGS Surface-Water Annual Statistics for the Nation - USGS 11413250 Slate Creek Tunnel. http://waterdata.usgs.gov/nwis.

eventually to Deer Creek (a tributary to the South Yuba). This conveyance of water provides irrigation and domestic water to NID's customers in addition to the hydropower generated.[13]

The movement of water from the South Yuba and North Fork of American River to the Bear River occurs under FERC #2310, PG&E's Drum Spaulding Project. PG&E and the NID also have separate hydropower generating plants and developed water supply and power purchase agreements within this system.[14] Under this system, North Fork American water is conveyed via the Lake Valley Canal to the Drum Canal, which deposits a portion of its flow into the Bear River. Gage readings (from USGS Gage 114126190) on Lake Valley Canal indicate that an average of 12,650 af/yr was conveyed from the North Fork American River watershed to the Bear River watershed from 1990 to 1998.[15]

7.3 Land Use Factors Affecting Water Supply and Demand

Although the topic of land use is covered more extensively in Chapter 10, a quick synopsis of predominant land uses and trends is provided here for context in understanding water supply and demand.

A variety of land uses occur in the Yuba County IRWMP region, with the majority in Yuba County being agricultural uses (51 percent), followed by public lands, which include Beale AFB (23 percent), urbanized or residential uses (16 percent), and resource extraction/production (3 percent).[16] Fruit and nut crops comprise the majority of agricultural production in Yuba County (54 percent), followed by field and vegetable crops (predominantly rice) (26 percent), livestock and apiculture (17 percent), and timber (3 percent).[17]

The region is composed of three general physiographic regions: the valley, foothills, and mountains. The valley is dominated by agricultural and urbanized areas, including Beale AFB, Marysville, Wheatland, and developed unincorporated areas. The foothills and mountain areas include land that has been traditionally used for grazing, timber production, and mining, though rural residential development is an increasing part of the foothill and mountain landscape.

Over the last few decades, the Yuba County IRWMP region has experienced a shift in land use away from traditional rural land uses such as irrigated agriculture, livestock grazing, and timber harvesting, and toward rural residential developments. This trend has been driven most recently by an influx of new residents from the 1990s to the early 2000s. In Yuba County, development has largely focused in and around the City of Wheatland, the unincorporated community of Plumas Lakes, and other unincorporated valley agricultural lands. From 1996 to 2007 the population of Wheatland and Plumas Lakes increased by approximately 65 percent. Due to the ring levee system that was constructed to protect the City of Marysville in the 1950s, most growth has occurred in unincorporated areas of the valley floor, and large areas of agricultural lands near State Routes 65 and 70 have been developed or approved for development. Three-quarters of Yuba County's population now lives outside the two cities. Even with this development, however, much of the fertile agricultural ground on the valley floor remains

[13] NID UWMP – update source and info. See comment above.
[14] Foothills Water Network (2006). Hydropower Relicensing Webpage: http://foothillswaternetwork.org/relicensing/index.php
[15] United States Geological Survey (2006a), USGS Surface-Water Annual Statistics for the Nation - USGS 11413250 Slate Creek Tunnel. http://waterdata.usgs.gov/nwis.
[16] Yuba County, General Plan Update Background Report (January 2008).
[17] Yuba County, General Plan Update Background Report: Agriculture (January 2008).

in active production today, representing the single most important economic activity and most prevalent land use in the county.[18]

Most foothill areas of the Yuba County IRWMP region have experienced only minor development with smaller subdivisions, although several pending development proposals could result in substantial land use change in the future and a sharp increase in population of the foothill areas.[19] Yuba County's population is expected to increase from 72,155 in 2010 to 143,973 in 2050, a twofold increase that equates to an average annual growth rate of approximately 2.5 percent.[20]

According to the USDA's 2007 Census of Agriculture, from 2002 to 2007, 73,231 acres of farms were lost (from 234,129 acres to 160,898 acres of farms), resulting in a 31 percent decrease in farmland in only five years.[21] Yuba County's 2008 General Plan Update Background Report on Agriculture shows that of the farmland converted between 1992 and 2006, approximately 3,480 acres was designated by the state as Prime Farmland.

Currently, urban areas constitute about 16 percent of the land cover in Yuba County, but this is expected to change as the region accommodates a large increase in population per projections from Department of Finance/Department of Water Resources. Most of the population growth in the Yuba County IRWMP region will be greatest in the valley region of the planning area (e.g., Olivehurst-Plumas Lake, Linda, Wheatland, and large areas around the State Route 65 and 70 corridors).

As a result of the adoption of the Yuba County 2030 General Plan, eight percent of the land in Yuba County is now planned for development, a number that will ultimately result in urbanized uses comprising 24 percent of the county's land area.[22] Growth in the Yuba County IRWMP region will affect the extent of open spaces and cause significant impacts on natural resources.[23] At the same time, it brings with it a larger tax base to pay for essential community services which are otherwise limited in rural areas. With the elimination of traditional land uses such as timber harvesting, farming, and ranching, local rural economies are more dependent on development and tourism-related revenues.

The SWRCB is establishing flow requirements for rivers that flow into the Sacramento-San Joaquin Delta (Delta) to meet the Delta's restoration and water supply goals. Many of these river systems' headwaters are located in the foothills region of the Plan area. If more water is required for flow into the Delta, it will largely originate from the upstream areas whose local water needs will likely be impacted and from which water is already being provided for downstream interests.[24] In 2010 SWRCB finalized the Development of Flow Criteria for the Sacramento-San Joaquin Delta (Flow Criteria), the purpose of which was to identify new flow criteria necessary for fish protection in the Delta ecosystem in accordance with the Delta Reform Act of 2009, Water Code Section 85000 et seq. The Flow Criteria do not have any regulatory or adjudicative effect but are used to inform planning decisions for the Delta Plan being prepared by the Delta Stewardship Council and through the collaborative Bay Delta Conservation Plan effort. The SWRCB recognizes that there are many other important beneficial uses that these waters support such as municipal and agricultural water supply and recreational uses. The SWRCB indicates in

[18] Yuba County, Yuba County 2030 General Plan (adopted June 7, 2009).
[19] Yuba County, General Plan Update Background Report (January 2008).
[20] US Census Bureau, quickfacts.census.gov; California Department of Finance, www.dof.ca.gov
[21] USDA, Natural Agricultural Statistics Service, 2007 Census of Agriculture: Yuba County, California.
[22] Yuba County, General Plan Update Background Report (January 2008).
[23] Center for Water Resources, UC Davis (1996), Sierra Nevada Ecosystem Project.
[24] Department of Water Resources, California Water Plan 2013 Update: pp. MC-48, 49 (2013).

Flow Criteria that it must consider and balance all competing uses of water in its decision-making. More broadly, the SWRCB has stated that it will factor in relevant water quality, water rights, and habitat needs as it considers potential changes to its Bay-Delta objectives.[25]

7.4 Summary of Supplies and Demands

Forecasting water supplies is challenging due to the influence of many variables, uncertainties, and poorly understood factors, such as the effects of climate change upon surface water supplies and groundwater recharge. Other uncertainties include changes in population and economic growth; changes in water use by households, businesses, and public facilities; agricultural land use and production; the need for irrigation; and future requirements and public desire for increased environmental benefit and/or economic growth.[26] The water forecast for the Yuba County IRWMP region should therefore be viewed as a broad forecast used to determine adequate management practices, and not as an exact future water demand calculation.

7.4.1 Municipal/Domestic Water Supplies

Table 7-1 provides a summary of normal-year and multiple-dry-year (third-year) water supplied to the water agencies for consumptive and/or irrigation use by right or contract. It is important to remember that all the urban areas of the county depend on groundwater as their single source of water supply.

The table presents data through 2030 that corresponds to each jurisdiction's Urban Water Management Plan (UWMP) or Master Water Plan. A comparison of normal-year supply to multiple-dry-year supply illustrates the region's ability to adequately respond to droughts and climate change projections while relying solely on groundwater for those supplies. The 2010 UWMPs for the City of Marysville, Linda CWD, and Olivehurst PUD are revised every 10 years based on updated state and federal policies. While the IRWMP Guidelines require a 20-year supply and demand horizon, data are currently available only for a 16-year horizon. As the local 2010 UWMPs are updated, supply and demand horizons will be expanded and incorporated into amendments or updates of this Plan.

[25] State Water Resources Control Board, California Environmental Protection Agency, Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem, Prepared Pursuant to the Sacramento-San Joaquin Delta Reform Act of 2009 (August 3, 2010).

[26] Groves, D.G., Matyac, S. and Hawkins, T., Quantified scenarios of 2030 California water demand. In California Water Plan Update 2005. Sacramento, CA: California Department Water Resources (2005).

Table 7-1. Normal and Multiple-Dry-Year Water Supplies by Agency							
Water Agency	**2015 Supply (af)**	**2015 Multiple-Dry-Year Supply (af)**	**2020 Supply (af)**	**2020 Multiple-Dry-Year Supply (af)**	**2030 Supply (af)**	**2030 Multiple-Dry-Year Supply (af)**	**Supply Source**
Linda CWD	16,470	16,470	16,470	16,470	16,470	16,470	Ground-water
California Water Service (for Marysville)	2,902	2,753	2,821	2,710	2,838	2,727	Ground-water
Olivehurst PUD	3,872	3,872	4,371	4,371	10,552	10,552	Ground-water
Beale AFB	1,130	1,130	1,130	1,130	1,130	1,130	Ground-water

Source: 2010 Urban Water Management Plans, http://www.water.ca.gov/urbanwatermanagement/2010uwmps/; Wheatland General Plan Update, Master Water Plan, Technical Report (2006).

As mentioned previously, rural communities within the Plan area, predominantly located in the foothills, use surface water for 85 to 90 percent of their water needs. Groundwater constitutes the remainder of the foothills' water supply, but is an important source for rural homes' individual water systems (wells) as well as small public and private water supply systems. Groundwater availability in the foothills area is often limited to fractured rock and small alluvial deposits immediately adjacent to the area's many streams. In the rural areas, many individual residences are not connected to a municipal water system and are dependent upon individual wells for domestic use, which are often unreliable during drought periods. [27]

Small water systems face unique financial and operational challenges in providing safe drinking water. Given their small customer base, many small water systems cannot develop or access the technical, managerial, and financial resources needed to comply with new and existing regulations. These water systems may be geographically isolated, and their staff often lacks the time or expertise to make needed infrastructure repairs, install or operate treatment facilities, or develop comprehensive source water protection plans, financial plans, or asset management plans.[28]

Residential communities near population centers may have local or regional water and wastewater districts that manage their water and wastewater treatment needs. These agencies are typically governed by state and federal regulations. Requirements under one law may contradict requirements under another law and solutions that fix a problem in one location may have negative or unintended consequences on resources in another location. Without a single responsible regulatory entity, agreed-upon data protocols, or a widely accessible funding source, planning and implementation of different land and water management programs can be uncoordinated.[29]

[27] Department of Water Resources, California Water Plan 2013 Update: pp. MC-13, 21 (2013).
[28] Ibid.
[29] DWR, California Water Plan: p. MC-48.

7.4.2 Municipal/Domestic Water Demands

Municipal water demand for the Yuba County IRWMP region is forecast using two variables: population and per-capita water use (gallons per capita per day or gpcd). Population is the primary variable used to calculate future urban water demand because housing growth, employment growth, and public sector water use are all correlated with population growth.[30] Yuba County's population is expected to grow at a moderate rate. The California Department of Finance projects an annual average growth rate in Yuba County of approximately 2.5 percent between 2010 and 2050, or a nearly 100 percent increase from 72,155 people in 2010 to 143,973 people in 2050. The vast majority of Yuba County's population occurs in population centers around State Routes 65 and 70, and most growth is anticipated in these areas, as well.[31]

The 20x2020 Water Conservation Plan identifies the state and regional baselines for water based on 2005 data. Per capita urban water use for the Sacramento River Hydrologic Region (SRHR), in which the Yuba County IRWMP region is located, is 253 gpcd. The 2015 target is a 10 percent reduction of this, or 215 gpcd, and the ultimate 2020 target for the SRHR is 176. For the state, if all urban water suppliers comply with the 20x2020 legislation, gpcd is expected to drop to 154 by 2020, saving nearly 2 maf based on a population of 37 million.[32]

The presence of fractured rock and small alluvial deposits in the foothills area of the Yuba County IRWMP region makes it difficult to quantify the upper watershed supplies. In the rural areas, groundwater wells are the primary source of water supply for individual residences. Groundwater wells are notoriously unreliable during periods of drought. As a result of unreliable groundwater and heavy reliance on surface water, local water supplies depend heavily on precipitation and corresponding runoff.[33] In more urbanized areas served by municipal water purveyors, water demand has historically been equivalent to water supply because supply is derived from groundwater sources.

7.4.3 Agricultural Water Supply and Demand

YCWA supplies irrigation water for agriculture as a wholesaler to the municipal customers as well as managing in-stream flows for the Yuba River. Irrigated agriculture is the predominant industry in the Yuba County IRWMP region and occurs primarily in the valley and lower elevations of the Sierra foothills. Summer water demand can vary by more than 50 percent in parts of the region. Agricultural water use is forecast by irrigated crop area, crop type, and water use by crop. Between 2001 and 2010, there was an average of 64,210 acres of farmed land, which includes an average of 1,138 acres of fallow or idle lands. The dominant crop in the service areas of the member units served by YCWA is rice, which was grown on an average of 38,480 acres (about 60 percent of farmed area). Pasture was grown on an average of 6,774 acres. Permanent crops in the YCWA member unit service areas are roughly equally split between walnuts and prunes and account for an average of 10,170 acres or roughly 16 percent of the total cropped area. Riparian areas, wetlands, and ponds cover 12 percent or about 5,550 acres of the farmed area.[34]

[30] Groves, D.G., Matyac, S. and Hawkins, T. Quantified scenarios of 2030 California water demand. In California Water Plan Update 2005. Sacramento, CA: California Department of Water Resources (2005).
[31] California Department of Finance, www.dof.ca.gov.
[32] Department of Water Resources, et al. (2010).
[33] Department of Water Resources, California Water Plan 2013 Update: pp. MC-13, 21 (2013).
[34] Yuba County Water Agency, Agricultural Water Management Plan (p. 5-15) (December 2012).

YCWA divides its member units into two regions north and south of the Yuba River, the "Northside" and "Southside," respectively. Over the 2001 to 2010 period, YCWA Northside member unit deliveries ranged from 147,000 af to 182,000 af for the calendar year with a wet year average of 168,000 af and a dry year average of 159,000 af. The overall average for the 10-year period was 162,000 af. In the Southside area, deliveries ranged from 84,000 af to 124,000 af with an overall average of 106,000 af, a wet year average of 115,000 af, and a dry year average of 103,000 af.

During dry years, YCWA and its member units reduce surface water deliveries and rely more heavily on groundwater, an act termed "groundwater substitution." Groundwater substitution in the Northside area ranged from 0 af to 47,000 af between 2001 and 2010 with an overall average of 16,000 af. Wet year and dry year average groundwater substitution pumping volumes were 0 af and 22,000 af, respectively. In the Southside area, groundwater substitution ranged from 0 af to 64,000 af between 2001 and 2010 with an overall average of 18,000 af. Wet year and dry year average groundwater substitution pumping volumes were 0 af and 26,000 af, respectively.

Some farms and many of the vineyards have developed wells with enough production to irrigate their lands in all but the driest of years. In the Northside area for eight of the ten years evaluated, a strong reliance on and access to Yuba River surface water was documented. In 2005 and 2007, it is estimated that 4,000 af and 12,000 af, respectively, were pumped to supplement surface water supplies. Overall average private pumping in the Northside area was 1,600 af and was similar in wet and dry years. In the Southside area, private pumping other than for groundwater substitution is greater than for the Northside because the Wheatland Water District did not begin receiving surface water in substantial amounts until 2010 via the Yuba Wheatland Canal Project (Wheatland Canal). Private pumping in the Southside area ranged from approximately 21,000 af to 34,000 af between 2001 and 2010 with an overall average of about 31,000 af. Pumping was similar in wet and dry years, averaging 33,000 af and 31,000 af, respectively.[35]

With the expected conversion of agricultural land to urban uses as discussed in Section 7.3, future agricultural water use is expected to decrease.[36] Some of the reduction in agricultural water use will occur with surface water deliveries from YCWA and its member units, while a part of the decrease will also be in the amount of groundwater used on individual farms not currently served by these agencies. Offsetting this decrease in water used for agricultural purposes is the Wheatland Canal, which in 2010 began delivering surface water to Wheatland Water District, previously dependent on groundwater. The Wheatland Canal increased surface water deliveries to agriculture by about 14,310 af/yr (the base project water supply; supplemental supply is up to 7,850 af/yr).

Agricultural water use for the planning area is forecast using irrigated crop area and applied water use. DWR has information on both variables for all of the Yuba County IRWMP region counties for 2001.[37]

Applied water use is the amount of water needed to grow one acre of a crop. Applied water use, expressed as acre-feet per acre (af/ac), is variable and influenced by soil characteristics, climate, and

[35] Yuba County Water Agency, Agricultural Water Management Plan (p. 5-52) (December 2012).

[36] Yuba County General Plan. www.yubavision2030.org/GPU%20-%20DOCUMENTS/Background%20Reports/Background%20Reports/Agriculture.pdf and City of Marysville Urban Water Management Plan (2011).

[37] California Department of Water Resources (2001). Land and water use from: http://www.landwateruse.water.ca.gov/docs/annualdata/2001/ICA_2001_by_Co(K-Ac).xls.

irrigation management and efficiency. DWR has information on applied water use per crop by county for 2005.

Table 7-2. Total Agricultural Applied Water Use in the Yuba County IRWMP Region				
County	Irrigated Acres in County*	Percent of Total County Ag in Yuba Region	Irrigation Acres in County in Yuba Region	Applied Water for Irrigated Ag Lands per County (af/acre)
Yuba	85,890	100	70,987	3.44
Total Acres:				Average = 3.29

*2007 Census of Agriculture
Total Applied Water use (af/yr) = (Total irrigated acres) X (Average Applied Water use), California Department of Water Resources (2010). Water Budget Workbook. www.water.ca.gov

Applied water use in the Sacramento River Hydrologic Region is expected to decrease by 2030. A decrease of two and four percent is projected under the Current Trends and Less Resource Intensive scenarios, respectively. Under the More Resource Intensive scenario, applied water use is projected to increase by two percent.

7.4.4 Environmental Water Demand

Environmental water demand is defined by DWR as the amount of water purposefully allowed to flow through natural river channels and wetlands that is not diverted or used for urban or agricultural purposes.[38] Environmental water demand in the region is the sum of:

1. dedicated flows in state and federal Wild and Scenic Rivers;
2. in-stream flow requirements established by the Yuba River Accord and FERC licensing; and
3. applied water demands of managed freshwater wildlife areas.

The Yuba County IRWMP region contains approximately 39 miles of state-designated Wild and Scenic status on the South Yuba from Spaulding Dam to the upper limit of Englebright Reservoir.[39] Designated flows from Wild and Scenic Rivers are available for other uses downstream, but not available in the Wild and Scenic designated areas. For 2001, DWR calculated the environmental water demand for the South Yuba River as 83,741 af.[40] Rivers identified as candidates for federal Wild and Scenic designation can be found in Chapter 6 *Region Description*.

Major tributaries of the Yuba, Bear, and Feather Rivers have undergone FERC relicensing processes during the last decade. More than $100 million in public funds have been invested in environmental studies and public collaboration to establish river flow regimes looking to balance the beneficial uses of water resources in the affected reaches. These flow regimes and associated environmental parameters are actively monitored and reported to regulatory agencies such as FERC, California Department of Public Health, and the SWRCB in accordance with the FERC licenses.

[38] Groves et al. (2005).
[39] California Department of Water Resources, Water plan data, wild and scenic rivers water use (2013 Update). Retrieved from http://www.waterplan.water.ca.gov/docs/waterpie/wpdata/WildandScenic.98.00.01.xls.
[40] Ibid.

As discussed in Chapter 6 *Region Description*, and Chapter 10 *Water and Land Use Planning*, the Lower Yuba River Accord (Yuba Accord) was implemented as a pilot program in 2006 and 2007, and fully implemented in 2008. Since that time, the Yuba Accord has resulted in significantly higher in-stream flow requirements for salmon and steelhead on the Lower Yuba River, an average of over 100,000 af of water transferred for fish and wildlife in the Bay-Delta estuary and for cities and farms throughout the state, and water rights protections for local farmers in Yuba County. The Yuba Accord's in-stream flows may be modified when FERC issues a new long-term Federal Power Act license to YCWA for the Yuba Project (FERC #2246) during or after 2016.

Minimum in-stream flows are generally met in the Yuba River in compliance with the Yuba Accord. However, this may become more difficult as warming and drying of the climate is projected to reduce regional surface flows in some streams, and future state water regulations and policies are uncertain.

7.5 Surface and Groundwater Infrastructure

The water supply infrastructure in the region was originally developed to support mining operations and agriculture, and to provide hydropower. It was later modified to provide public water supplies for domestic, municipal, industrial, and agricultural use, especially during dry months.

The Yuba County IRWMP region includes substantial and extensive water infrastructure of several irrigation districts, municipal water agencies, county water agencies, and utility companies, as shown in **Figure 7-2**. These entities' facilities include an array of canals, flumes, tunnels, ditches, pipelines, penstocks, dams, and powerhouses. The infrastructure provides multiple benefits to the region's residents, the greater Sacramento Valley, and, to a lesser extent, statewide, including treated water, regulated flow for hydropower production, recreational opportunities, environmental benefits and streamflow releases, opportunities for out-of-district sales, aesthetic resources, and agricultural irrigation. The larger dams are operated by water agencies, irrigation districts, public utility districts, or PG&E. Many small dams and/or diversions in the watersheds are owned and operated by smaller entities or private individuals. Overall, the major rivers of the Yuba County IRWMP region contain a significant amount of water-related infrastructure as described below.

The infrastructure in the Yuba County IRWMP region is aging and in many cases dates back to Gold Rush-era construction and uses. In addition, limitations on reservoir dredging due to mercury contamination from the Gold Rush era impacts traditional methods used to maintain reservoir capacities. Additional investment in these resources, both from within and outside the region commensurate with benefits received, is essential to continue reliable and cost-effective water supply and wastewater management throughout the region.

Table 7-3 lists the primary reservoirs and corresponding operators that supply the surface water needs both within the Yuba County IRWMP region and for export from the region. In addition to the major reservoirs and lakes listed below, several small water agencies in the Yuba County IRWMP region have water rights and own and operate small-scale conveyance and storage facilities.

Figure 7-2

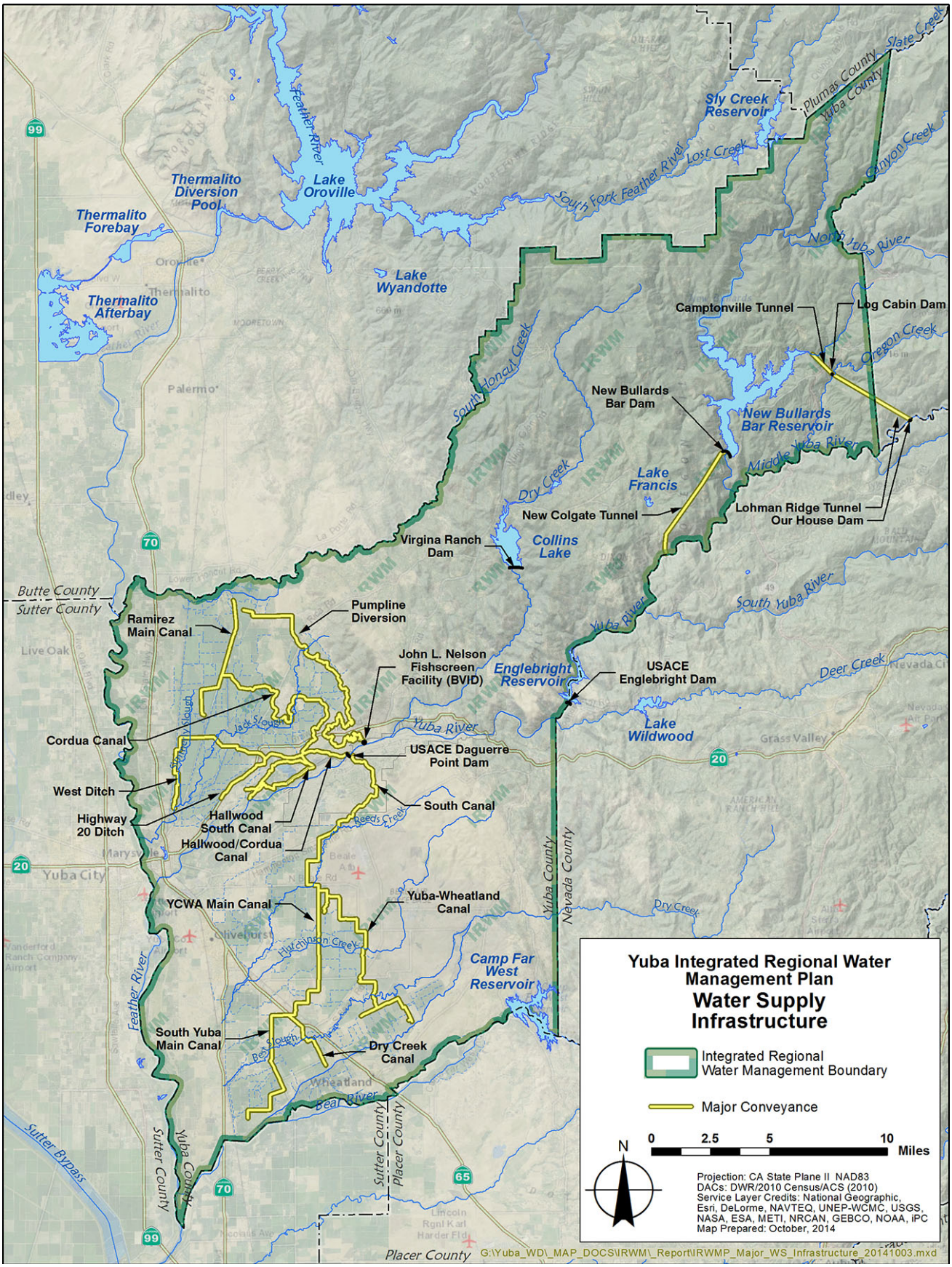

Yuba Integrated Regional Water Management Plan
Water Supply Infrastructure
Integrated Regional Water Management Boundary
Major Conveyance
0 2.5 5 10 Miles
N
Projection: CA State Plane II NAD83
DACs: DWR/2010 Census/ACS (2010)
Service Layer Credits: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC
Map Prepared: October, 2014
G:\Yuba_WD_MAP_DOCS\IRWM_Report\IRWMP_Major_WS_Infrastructure_20141003.mxd
Thermalito Forebay
Thermalito Afterbay
Thermalito Diversion Pool
Lake Oroville
Feather River
Lake Wyandotte
Sly Creek Reservoir
Plumas County
Yuba County
Slate Creek
Lost Creek
South Fork Feather River
Canyon Creek
North Yuba River
Camptonville Tunnel
Log Cabin Dam
Oregon Creek
New Bullards Bar Dam
New Bullards Bar Reservoir
Middle Yuba River
South Honcut Creek
Dry Creek
Lake Francis
New Colgate Tunnel
Lohman Ridge Tunnel
Our House Dam
Virgina Ranch Dam
Collins Lake
Butte County
Sutter County
Ramirez Main Canal
Pumpline Diversion
South Yuba River
Yuba River
John L. Nelson Fishscreen Facility (BVID)
Englebright Reservoir
USACE Englebright Dam
Deer Creek
Lake Wildwood
Cordua Canal
Jack Slough
USACE Daguerre Point Dam
West Ditch
Highway 20 Ditch
Hallwood South Canal
Hallwood/Cordua Canal
South Canal
Reeds Creek
Yuba City
Yuba-Wheatland Canal
YCWA Main Canal
Hutchinson Creek
Yuba County
Nevada County
Dry Creek
Camp Far West Reservoir
Feather River
South Yuba Main Canal
Dry Creek Canal
Bear Slough
Wheatland
Bear River
Sutter Bypass
Sutter County
Placer County
Lincoln
Placer County

Table 7-3. Major Reservoirs and Lakes in the Yuba County IRWMP Region			
Reservoir/Lake	Stream/River Outflow	Capacity (af)	Operator
Collins Lake	Dry Creek	57,000	Browns Valley Irrigation District
Englebright	Yuba	70,000	US Army Corps of Engineers
Our House Dam	Middle Fork Yuba	280	Yuba County Water Agency
Log Cabin Diversion Dam	Oregon Creek/Middle Yuba	90	Yuba County Water Agency
New Bullards Bar	Canyon Creek (Yuba)	966,103	Yuba County Water Agency

Source: Reservoir information obtained from DWR, Division of Flood Management website (http://cdec.water.ca.gov/misc/resinfo.html) and from agency sources.

7.5.1 Yuba River Watershed

The resources of the Yuba River are managed for multiple beneficial uses, including water supply, hydropower generation, recreation, flood control, and environmental benefits. Entities with management responsibilities include YCWA and small and individual water rights holders inside the region; and NID, South Feather Water and Power Authority, and PG&E upstream. Water is transported through a system of tunnels and canals to the Feather, Bear, and American Rivers. The New Bullards Bar Dam, which forms New Bullards Bar Reservoir, is located on the North Fork Yuba River and is operated by the YCWA. On the Middle Yuba River is the Our House Dam located southwest of Camptonville. This dam diverts Middle Yuba River water through Lohman Ridge Diversion Tunnel into Oregon Creek, and then further diverts water into the Camptonville Diversion Tunnel and sends it the New Bullards Bar area where it is used to generate hydropower in the North Yuba Hydroelectric Project (FERC No. 2246). Englebright Dam, located on the Yuba River, generates hydropower and provides recreation opportunities.

7.5.2 Upstream Reservoirs

Upstream and east of the Plan area, the Middle Yuba River development includes Jackson Meadows Dam operated by NID, which stores water that is later transferred to the South Yuba via the Milton-Bowman Conduit and Bowman-Spaulding Canal. Spaulding Dam on the South Yuba River diverts 66 percent of flow from the South Yuba, and Spaulding Lake is the major reservoir for the Drum Spaulding Project (FERC No. 2310) owned and operated by PG&E.

The Bear River watershed is extensively managed for water conveyance. Both NID and PG&E utilize the Bear River watershed to convey water supplies to residents, farms, and ranches of Nevada and Placer Counties, as well as to generate hydropower for the California electric grid. Water is imported from the Yuba and American Rivers into this watershed. An estimated 200,000 af of water is imported annually from the South Fork of the Yuba River, from Spaulding Lake through the Drum Canal system, and from the North Fork of the North Fork American River through the Lake Valley Canal. Water in the upper Bear watershed is directed into Rollins Reservoir. PG&E's Bear River Canal (below Rollins Reservoir) and the NID's Combie Phase I Canal (below Combie Reservoir), serve as important conveyance systems. Flows in

the watershed are managed primarily by NID and PG&E.[41] Dams on the Bear River include Rollins Dam and Camp Far West Dam.

7.5.3 Downstream Infrastructure

The rivers and streams in the Yuba County IRWMP region provide water for the Bay-Delta system, the State Water Project (SWP), and the Central Valley Project. This water supply infrastructure depends on a complex system of dams, reservoirs, power plants, pumping plants, and canals to deliver water to users, provide electricity, and for flood control protection. The CALFED Bay-Delta Authority was created in 1995 to address environmental and water management problems associated with the Bay-Delta system, an intricate web of waterways at the junction of the San Francisco Bay and the Sacramento and San Joaquin River Delta. Water flowing out of the Yuba County IRWMP region drains to the Sacramento River and is used in the Bay-Delta system. The SWP is a water and hydropower development and conveyance system operated by DWR that supplies water to 23 million Californians and 755,000 acres of farmland.[42] There are no SWP-operated dams or reservoirs in the Yuba County IRWMP region, although water originating in the region is part of the SWP water supply. Reservoirs in the Yuba County IRWMP region not only help prevent flooding in the Central Valley and reduce pressure on the downstream levee system in the valley, but they also provide regulated water supply for later downstream municipal, industrial, and irrigation use outside the Yuba County IRWMP region.

7.6 Administration and Management

Urban water supply in the Yuba County IRWMP region is administered and managed primarily by 14 local public agencies for the benefit of local citizens, complying with pertinent federal and state laws and guidelines. These entities are YCWA, City of Marysville (Cal Water Agency), Beale AFB, Olivehurst PUD, Linda CWD, North Yuba Water District, Hallwood Irrigation Company, Cordua Irrigation District, Ramirez Water District, Browns Valley Irrigation District, Brophy Water District, South Yuba Water District, Dry Creek Mutual Water Company, and Wheatland Water District. Other smaller public agencies and private water companies in the region procure, treat, and distribute water at various levels, generally within geographically limited areas.

7.6.1 Water Conservation

Yuba County IRWMP region purveyors have fully metered and billed services, and have long employed best management practices such as tiered rate structures, inclining block rate structures on a volumetric basis, residential water audits, and canal lining/piping projects. Water users are receptive to short-term, low-magnitude water curtailment measures. Receptivity to longer-term and/or greater magnitude, measures is unknown.

Conversion of unmetered connections to metered connections with volumetric pricing is the primary tool in promoting water conservation. In fact, the California Urban Water Conservation Council estimates in its Utility Operations Program, “Metering with Commodity Rates,” a 20 percent reduction in demand should result from metering and volumetric pricing. This would imply that metering and volumetric

[41] Eberhart, Allan. Bear River Watershed Assessment, Number 4 (2006), from: http://motherlode.sierraclub.org/4-BearRiver.htm.
[42] State of California, Governor’s Budget 2009-10.

pricing alone could satisfy the 20 percent conservation requirement of SB X7-7 for agencies that currently have unmetered connections, or that Yuba agencies, already metering and employing volumetric pricing, have achieved 20 percent water conservation. Since traditional water conservation practices have already largely been employed by Yuba water purveyors, it will be more difficult and costly to achieve an additional 20 percent savings. In any case, additional conservation efforts are underway by all purveyors at varying levels to start (or continue) an agriculture irrigation management service for growers.

Senate Bill X7-7, enacted in November 2009, requires all water suppliers (urban and agricultural) to increase water use efficiency. Urban conservation as described in this bill is measured in gpcd, and must decrease by 20 percent by the year 2020. Urban per capita water use includes residential (including landscape), commercial, industrial, and institutional uses of water. Each urban water supplier (providing more than 3,000 af/yr or serving more than 3,000 connections) must report the gpcd for their service area based on calculation methods outlined in the bill, and these must be included in their five-year updated UWMPs. Olivehurst PUD, Marysville, and Linda CWD all completed and submitted 2010 UWMPs to DWR, and use projections are based on these numbers. The "base year," 2015, and 2020 projections are shown below.

Table 7-4. Yuba County IRWMP Region Urban Water Suppliers' Conservation Targets (based on SB X7-7, as reported in water agencies' 2010 UWMPs)

Urban Water Supplier	Base Year (2010, gpcd, 5-yr average)	2015 goal	2020 goal	Percent decrease in gpcd between base year and 2020
Olivehurst PUD	197	167	149	48
Marysville	223	225	200	23
Linda CWD	195	181	167	28

The 20x2020 Water Conservation Plan identifies the state and regional baselines for water based on 2005 data. Per capita urban water use for the Sacramento River Hydrologic Region (SRHR) is 253 gpcd. The 2015 target is a 10 percent reduction of this, or 215 gpcd, and the ultimate 2020 target for the SRHR is 176. For the state, if all urban water suppliers comply with the 20x2020 legislation, gpcd is expected to decrease to 154 by 2020, saving nearly 2 maf based on a population of 37 million.[43]

Typical of a large part of the Yuba County IRWMP region, people are watering livestock and irrigating gardens and small orchards, therefore using more water than typical residential uses. However, this type of water use promotes regional sustainability because it is more efficient to grow farm products locally and avoid long-distance transport as well as irrigate with gravity-fed water systems rather than to export, pump, and re-pump water. Current state water policy does not recognize this water-and-energy-conserving difference between urban and rural water use.

Another issue unique to source area water supply systems not recognized in state policy is the miles of raw water conveyance systems, typically remnants of the Gold Rush era, that have a great potential for water savings. These systems are characterized by raw-water conveyance: earthen ditches and lined canals that typically experience greater water loss than urban potable water systems where water is

[43] DWR et al. 20x2020 Water Conservation Program (2010). www.google.com/?gws_rd=ssl#q=DWR+2010+20x2020

pumped directly out of the river or ground and injected into the potable water system. Regarding conservation credit toward 20x2020 compliance, current state policy draws an arbitrary line for measuring water conservation just downstream of a municipal water treatment plant. This policy provides no incentive for improvements in raw-water systems where losses are sometimes the greatest, and therefore little advantage in funding for raw-water projects tied to that policy.

7.7 Water Supply and Climate Change

A synopsis of the effects of climate change on water supply is included here; please see Chapter 11 *Climate Change* for a full discussion of trends and projections affecting water supply.

Climate change will likely alter the timing and amount of water available within the Yuba County IRWMP region, and water managers will be challenged to adapt to these changes. Climate change is expected to intensify seasonal water shortage (due to less snowpack, earlier snowmelt, and net drying of the climate). Although geography and high occurrence of microclimates will influence these changes, higher air temperatures are predicted for the warmer seasons, generally resulting in less available water overall.

Overall climate drying could ultimately impact groundwater recharge. Further, increased use of groundwater could occur to compensate for a combination of climate warming and drying and reduced surface water supplies.

Water delivery managers and purveyors, and hydroelectric generation managers may face far more complex hydrologic management system adjustments when accommodating intense rainfall events versus the historically common gradual snowmelt. Uncertainty puts added pressure on managers to deliver a resource necessary to meet the demands of a growing economy and population.

Much of the region's freshwater resources originate on forested lands. Healthy forests capture and store water, naturally regulate streamflows and water quality, reduce flood and storm damage, control erosion, and replenish groundwater. Wildfire occurrence and intensity is expected to increase over time, potentially impacting watershed health and the ability to harbor healthy riparian conditions.

Chapter 8 *Water Quality*

8.0 Introduction

Stakeholders in the Yuba County IRWMP region share a common concern for water quality protection. The Yuba County IRWMP region typically meets and exceeds state and federal regulatory standards, with a few critical exceptions. However, accumulating salts and nitrates in the Central Valley, sediment, mercury, water temperature, and aquatic invasive species require monitoring and intervention to ensure continued high-quality water in the future. This chapter describes water quality problem areas, especially locations with extensive historic mining, which caused degradation in the foothill elevations. Specific strategies for addressing water quality issues are discussed in Chapter 12 *Goals, Objectives, Issues, and Conflicts*.

8.1 Water Quality Regulatory Framework

The Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin River Basins establishes the standards and guidelines for water quality protection in the Yuba County IRWMP region. The following section provides an overview of the Basin Plan, Central Valley Salinity Coalition, Irrigated Lands Regulatory Program (ILRP), and DWR watershed management initiatives that guide water quality protection measures described in this IRWMP. The section also provides a brief summary of water projects in the region that match water quality with water use.

8.1.1 Basin Plan for the Sacramento River Basin[1]

Congress delegated the primary responsibility for implementing the Clean Water Act (CWA) of 1970, as amended, to the US Environmental Protection Agency (EPA), and the EPA has designated the State Water Resources Control Board (SWRCB) as the water pollution control agency with authority to implement the CWA in California (see Water Code Section 13160). The SWRCB and the state's nine Regional Water Quality Control Boards (RWQCBs) work in a coordinated manner to implement and enforce the CWA, as provided for in the state's Porter-Cologne Water Quality Act. The Yuba County IRWMP region is within the jurisdiction of the Central Valley RWQCB.

The CWA requires that the US EPA adopt water quality standards for surface waters within the United States, and that these standards be reviewed and revised, if necessary, at least every three years. The SWRCB carries out its water quality protection authority through the application of specific Regional Water Quality Control Plans, formulated and adopted by the RWQCBs, which submit these plans to the SWRCB for review. The SWRCB revises them as necessary and approves them (Water Code Section 13245).

8.1.1.1 Basin Plan Goals and Objectives Related to Yuba IRWMP

State water quality standards "consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses" [33 USC Section 1313(C)(2)(A)]. RWQCB basin plans provide standards through: 1) designation of existing and potential beneficial uses, 2) water

[1] Excerpted from Yuba County Water Agency Pre-application Document (2009).

quality objectives to protect those beneficial uses, and 3) programs of implementation needed to achieve those objectives. The RWQCBs are required to consider a number of items when establishing water quality standards, including: 1) past, present, and probable future beneficial uses; 2) environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto; 3) water quality conditions that could reasonably be achieved through the coordinated control of all factors that affect water quality in the area; and 4) economic considerations.

SWRCB's management goals are specified in the Central Valley RWQCB's Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin Rivers, the fourth edition of which was initially adopted in 1998 and which was most recently revised in 2009 (Central Valley RWQCB 1998). The Basin Plan formally sets forth designated existing and potential beneficial uses and water quality objectives for the region, including the Yuba River and the entire Yuba County IRWMP region.

The Basin Plan divides the Yuba River into two Hydro Units (HUs): 1) HU 517, which includes the Yuba River and its tributaries upstream of the US Army Corps of Engineers' (USACE) Englebright Reservoir; and 2) HU 515.3, which includes the Yuba River from USACE's Englebright Dam to the Feather River.

Beneficial Uses

The Basin Plan identifies the following beneficial uses:

- Municipal and domestic supply
- Agricultural supply
- Industrial service supply
- Industrial process supply
- Groundwater recharge
- Freshwater replenishment
- Navigation
- Hydropower generation
- Water contact recreation
- Non-contact water recreation
- Commercial and sport fishing
- Aquaculture
- Warm freshwater habitat
- Cold freshwater habitat
- Estuarine habitat
- Wildlife habitat
- Preservation of biological habitats of special significance
- Rare, Threatened, or Endangered species

Water quality objectives included in the Basin Plan set criteria for meeting the Plan's goals for several water quality parameters. Parameters identified in the Basin Plan for both surface waters and groundwater are listed below.

Water Quality Objectives to Protect Beneficial Uses

Water quality objectives included in the Basin Plan establish criteria for meeting the Plan's goals for several water quality parameters. Parameters identified in the Basin Plan for inland surface waters are as follows:

- Bacteria
- Biostimulatory substances
- Chemical constituents
- Color
- Dissolved oxygen
- Floating material
- Oil and grease
- pH
- Pesticides
- Radioactivity
- Salinity
- Sediment
- Settleable material
- Suspended material
- Tastes and odors
- Temperature
- Toxicity
- Turbidity

Parameters identified in the Basin Plan for groundwater are as follows:

- Bacteria
- Chemical constituents
- Radioactivity
- Tastes and odors
- Toxicity

8.1.2 Central Valley Salinity Coalition

Central Valley Salinity Alternatives for Long-term Sustainability (CV-SALTS) is a multi-stakeholder process in the Central Valley to address the long-term build-up of salts and nitrates in the Central Valley. Through this collaborative process stakeholders, including the RWQCB, are developing a Central Valley Salt and Nutrient Management Plan (SNMP) and associated Basin Plan amendments to implement the SNMP.

The Statewide General Landscape Irrigation Permit for recycled water requires enrollees to participate in regional salt and nitrate planning. CV-SALTS has developed guidelines to allow entities to participate through membership agencies, such as Central Valley Clean Water Association (CVCWA), or as individual agencies. Participation includes active participation in meetings as well as contributions, either through the Central Valley Salinity Coalition, the funding arm of CV-SALTS, or in-kind services.

In December 2012, the CVCWA board established the CV-SALTS Special Project. The primary purposes of this special project are to support CVCWA's membership in CV-SALTS and the Central Valley Salinity Coalition (CVSC) and provide regulatory credit for "active participation in CV-SALTS" through CVCWA to agencies participating in this special project.

8.1.3 Irrigated Lands Regulatory Program

California agriculture is extremely diverse and spans a wide array of growing conditions from northern to southern California. California's agriculture includes more than 400 commodities. The state produces nearly half of US-grown fruits, nuts, and vegetables, and many of the products are exported to markets throughout the United States and worldwide. Water discharges from agricultural operations in California include irrigation runoff, flows from tile drains, and stormwater runoff. These discharges can affect water quality by transporting pollutants, including pesticides, sediment, nutrients, salts (including selenium and boron), pathogens, and heavy metals from cultivated fields into surface waters. The state's groundwater bodies have suffered pesticide, nitrate, and salt contamination.

To prevent agricultural discharges from impairing receiving waters, the ILRP regulates discharges from irrigated agricultural lands, including Yuba County. This is done by issuing waste discharge requirements (WDRs) or conditional waivers of WDRs (Orders) to growers. These Orders contain conditions requiring water quality monitoring of receiving waters and corrective actions when impairments are found. About six million acres of agricultural land statewide are enrolled in the ILRP, controlled by about 40,000 growers.

In 2003, the Central Valley RWQCB decided on three options for growers to avoid pollution of rivers, streams, and creeks by pesticides, fertilizers, sediment, and other pollutants: 1) join a coalition group and apply for a group waiver, or 2) apply for an individual discharger waiver, or 3) submit a complete application for a permit. The coalition group waiver and the individual discharger waiver require owners and/or operators of irrigated lands to manage their operations so they do not cause or contribute to surface water pollution. The waivers contain conditions that require water quality monitoring, implementation of management practices to address water quality problems, and reporting to the RWQCB. In order to comply with the conditions of the waivers, coalition groups and individual growers will review the available data for their watershed, develop monitoring plans, and prioritize their efforts to address known problems or pollutants of concern, such as pesticides or nutrients.

Participating in a coalition group is the simplest and most economical way to comply with the requirements. A coalition group is any group receiving RWQCB approval to operate under the terms and conditions of the coalition group conditional waiver. Coalition groups organize growers to share best management practices, conduct monitoring of rivers and creeks, apply for grants, and work cooperatively toward improving water quality. In addition to growers, coalition groups may include representatives from the farm bureaus, county agricultural commissioners, resource conservation districts (RCDs), the Natural Resource Conservation Service, farm advisors, and water agencies. The Butte-Yuba-Sutter Water Quality Coalition (BYSWQC) is one of the 10 subwatersheds that comprise the Sacramento Valley Water Quality Coalition. More information about this main watershed coalition is available at www.svwqc.org.

As of December 2006, in order to join any coalition group, a grower must apply to the RWQCB for approval by filing a completed form ILRP 5.0 and paying a $50 application fee. Information on the ILRP from the RWQCB is available at www.waterboards.ca.gov/centralvalley/water_issues/ irrigated lands/.

After the grower has received board approval, he or she may then join the BYSWQC by submitting the required information and paying all current dues, as well as any past dues if appropriate. The BYSWQC is governed by a board of trustees comprised of three members from each county. After the grower has received board approval, the entity may then join the BYSWQC by submitting the required information and paying all requisite dues.

8.1.4 Watershed Management Initiative for the Sacramento Hydrologic Region (2003)

The Watershed Management Initiative (WMI) was approved as part of the 1995 SWRCB Strategic Plan and remains a part of the current Strategic Plan. The premise of watershed management is that water quality and ecosystem problems are best prioritized, addressed, and solved at the local watershed level rather than at the individual discharger, water body, or state agency level. The watershed approach has opened the door to a more holistic method of solving environmental and resource management

problems by using the energy, knowledge, and experience of locally based watershed partnerships. In turn, the state recognizes that it has an ongoing responsibility to help local stakeholders assess their watersheds, create watershed plans, and implement watershed management measures to address broad concerns, such as those involving water quality, riparian and wildlife habitat, water supply, flooding, and fires—the many issues that often cross political and regulatory boundaries and therefore require significant coordination in order to find solutions.

The WMI establishes a broad framework overlying the numerous federal- and state-mandated priorities. As such, the WMI helps the RWQCBs achieve water resource protection, enhancement, and restoration while balancing economic and environmental impacts.

8.1.4.1 WMI Goals and Objectives

The integrated approach of the WMI involves three main ideas:

1. Use water quality to identify and prioritize water resource problems within individual watersheds. Involve stakeholders to develop solutions.
2. Better coordinate point source and nonpoint source regulatory efforts. Establish working relationships between staff from different programs.
3. Better coordinate local, state, and federal activities and programs, especially those relating to regulations and funding, to assist local watershed groups.

The Yuba, Bear, and Feather watersheds are part of the Sacramento Hydrologic Region WMI. The Yuba County IRWMP region's water quality issues are compatible with the issues addressed in the Central Valley RWQCB's 2003 Watershed Management Initiative, Central Valley Reports.[2] These common issues include metals, sedimentation, and temperature.

8.2 Current Water Quality Conditions

Surface water quality for human consumption is considered good in the region. Water quality concerns for ecosystems, however, include sediment and mercury deposition from past mining; sediment from development, recreation, and road-building activity; temperature increases brought on by water storage and diversion, inadequate shading, and low flows; and impairment due to elevated levels of copper and zinc. These contaminants are not considered significant in the context of existing drinking water supplies or treatment.

Historic land use practices in the upper elevations, beginning with mining more than 150 years ago, compromised water quality in certain areas. Hydraulic and/or placer mining in some areas completely altered stream geomorphology and caused heavy metal contamination from mercury, copper, and zinc as a result of mine operations. Significant deposits of mining debris still persist in the Yuba County IRWMP region, especially below Englebright Reservoir along the Lower Yuba River.

[2] State Water Resources Control Board, Watershed Management, www.waterboards.ca.gov/water_issues/programs/watershed/#wmi.

8.2.1 Yuba County IRWMP Region Drinking Water Quality

The Yuba County IRWMP region watersheds and groundwater subbasins are a critical source of drinking water. The California Department of Public Health (CDPH) requires all surface water suppliers to conduct a watershed sanitary survey and update that study every five years. The watershed sanitation surveys conducted in the upper reaches of the Yuba County IRWMP region have found the watershed to have excellent drinking water quality.[3] YCWA's continuous monitoring of water treatment plants includes source water entering the treatment system, water in the treatment processes, and the treated water.

In a 2008 survey, no wells less than 200 feet deep exceeded drinking water Maximum Contaminant Levels (MCL) in the North subbasin. In the South subbasin, one well less than 200 feet exceeded the MCL for nitrate. Wells greater than 200 feet deep commonly approach or exceed the MCL for total dissolved solids. Further, most areas in the region show increasing trends for total dissolved solids (TDSs) and alkalinity. Elevated levels of TDSs are associated with deep groundwater pumping and can negatively impact irrigated agriculture and the taste of domestic drinking water. [4]

8.2.2 Clean Water Act Section 303(d) List

Table 8-1 lists the 303(d)-listed (2010 list) water bodies in the Plan area classified as impaired because they are unable to support certain designated beneficial ecosystem functions. Similar to the Cosumnes, American, Bear, Yuba (CABY) region and other foothill regions, the heavy metal pollution legacy (primarily mercury) is the most high-profile water quality contaminant in the region and poses significant risks to aquatic organisms and ecosystem health. **Figure 8-1** shows the 303(d)-listed water bodies in the Plan area. Mercury is introduced in this section in the context of 303(d) listings, while bioaccumulation of mercury is discussed below in the "mercury" section.

The Lower Yuba River watershed has seven water bodies (Deer Creek, Englebright Reservoir, Scotts Flat Reservoir, Yuba River, South Fork Yuba, Middle Fork Yuba, and North Fork Yuba) listed as impaired due to mercury, arsenic, copper, chlorpyrifos, diazinon, and/or temperature. The lower Bear watershed has six impaired water bodies (Lake Combie, Lower Bear River, and Camp Far West Reservoir), mostly due to mercury contamination but with secondary contamination from chlorpyrifos and diazinon.

The State of California identified the Bear River and South Fork Yuba River as Priority 1 Impaired Watersheds requiring restoration to improve water quality as a result of the large amounts of mercury.[5]

[3] Nevada Irrigation District and Placer County Water Agency, Watershed Sanitation Surveys (2012).

[4] YCWA Relicensing Studies (2010). http://www.ycwa-relicensing.com/FERCApproved%20Studies/Forms/AllItems.aspx

[5] California Regional Water Quality Control Board (2004, as amended). Fourth edition of the water quality control plan (basin plan) for the Sacramento River and San Joaquin River Basins. Sacramento, CA: California EPA. http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/

Table 8-1. 2010 Clean Water Act Section 303(d) List of Water Quality-Limited Segments Within the Yuba County IRWMP Region

Watershed	Water Body	Pollutant/Stressor	Potential Sources	Estimated Size Affected	Expected TMDL Completion Date
Yuba	Deer Creek (Yuba County)	pH/Mercury	Resource Extraction	4.3 miles	2019
	Englebright Reservoir	Mercury	Resource Extraction	754 acres	2016
	Scotts Flat Reservoir	Mercury	Resource Extraction	660 acres	2016
	Yuba River, Lower	Mercury	Resource Extraction	10 Miles	2021
	Kanaka Creek	Arsenic	Resource Extraction	9.7 miles	2020
	Yuba River, Middle Fork	Mercury	Resource Extraction	45 Miles	2021
	Yuba River, North Fork	Mercury	Resource Extraction	37 Miles	2021
	Yuba River, South Fork (Spaulding Reservoir to Englebright Reservoir)	Mercury/ Temperature	Resource Extraction	48 Miles	2021
Bear	Lake Combie	Mercury	Resource Extraction	362 acres	2015
	Bear River, Lower	Chlorpyrifos Copper Diazinon Mercury	Agriculture Source Unknown Agriculture Resource Extraction	21 Miles	2021 2021 2010 2015
	Camp Far West Reservoir	Mercury	Resource Extraction	1,945 acres	2015
	Wolf Creek	Fecal coliform	Source Unknown	23 Miles	2019
	French Ravine	Bacteria	Land Disposal	1.7 Miles	2019
	Humbug Creek	Copper Mercury Sedimentation/Siltation Zinc	Resource Extraction	2.2 Miles	2020 2021 2012 2020
	Rollins Reservoir	Mercury	Resource Extraction	774 Acres	2016

Feather	Feather River, Lower (Lake Oroville Dam to Confluence with Sacramento River)	Chlorpyrifos Group A Pesticides Mercury PCBs (Polychlorinated biphenyls) Unknown Toxicity	Agriculture Agriculture Resource Extraction Source Unknown	42 Miles	2019 2011 2012 2019 2021
	Simmerly Slough	Unknown toxicity	Source Unknown	5.5 Miles	2021
	Honcut Creek	Oxygen, Dissolved	Source Unknown	10 Miles	2021

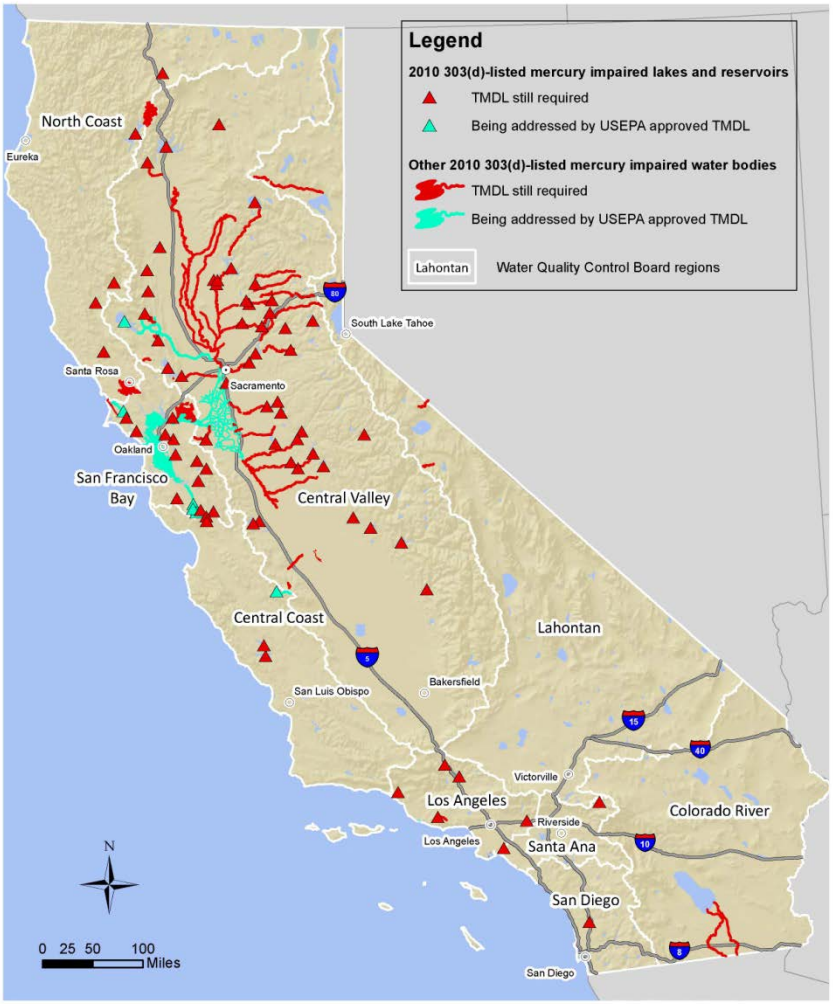


Figure 8-1: State Water Resources Control Board map of 303(d)-listed water bodies in California that may be addressed through the proposed Statewide Mercury Policy (SWRCB 2012)

As displayed in **Figure 8-1** above, the Yuba County IRWMP region includes a high concentration of listed water bodies compared to other regions in the state.

The following section is based largely on information included in the CABY IRWMP. As described in Chapter 6 *Region Description*, the two regions overlap in the upper watershed and the following discussion concerning mercury is directly relevant to both regions. In many places mercury concentrations violate federal water quality limits as well. The SWRCB and nine RWQCBs are currently in the process of developing a statewide policy to control mercury in California's waters. Key elements of the policy will include a control program for mercury in the state's reservoirs and new standards (objectives) for mercury in the tissues of certain species of fish.

Under this policy, reservoir operators, land managers, and others will be expected to design and implement sediment and mercury control programs to comply with the policy's requirements and reduce mercury contributions to the state water system. This policy will have serious cost implications for water managers as well as to rate payers from potential pass-through charges.

Table 8-2. Impaired Water Bodies and Fish Advisories Inside and Downstream of the Yuba County IRWMP Region

Streams listed as impaired	County	Pollutant	Fish Advisory	Species
Yuba River Watershed				
Englebright Reservoir	Yuba, Nevada	Mercury	Mercury, 3/18/09	Rainbow trout; bluegill or other sunfish; and largemouth, smallmouth, or spotted bass
Bear River Watershed				
Camp Far West Reservoir	Yuba, Nevada, Placer	Mercury	Mercury, 3/18/09	Bluegill or other sunfish; largemouth, smallmouth, or spotted bass, catfish
Feather River Watershed				
Feather River, Lower (Lake Oroville Dam to Confluence with Sacramento River)	Yuba, Butte, Sutter	Mercury or PCBs		Steelhead trout, American shad, Chinook salmon, bluegill or other sunfish; largemouth, smallmouth, or spotted bass, catfish

Sources: California Environmental Protection Agency, State Water Resources Control Board, Impaired Water Bodies, 2010 Integrated Report (Clean Water Act Section 303(d) List / 305(b) Report), Statewide; 303(d) list, http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml; California Office of Environmental Health Hazard Assessment, Advisory Map, http://www.oehha.ca.gov/fish.html (2013)

Fish tested in tributaries of the Yuba River were among the highest in mercury in a statewide survey completed by the SWRCB's Surface Water Ambient Monitoring Program.[6] The findings from the most comprehensive survey of fish in the Yuba and Bear watersheds found that fish tissue levels meet and exceed California EPA (Cal/EPA) Office of Environmental Health Hazard Assessment (OEHHA) and Food and Drug Administration (FDA) levels (0.3ppm mercury in fish tissue):[7]

- Englebright Reservoir: all smallmouth and spotted bass that were >1 foot and >250 grams (1/2 lb) had levels >0.3 ppm; and
- Camp Far West: all spotted and largemouth bass and channel catfish >1 foot and >300 grams had levels >0.5 ppm, half of the spotted bass exceeded FDA level of 1.0 ppm.

In the summer of 2013, the State of California released comprehensive safe-eating guidelines for fish from all California's lakes and reservoirs that do not have location-specific guidelines issued. This means that there is now information available for any lake fished in the Sierra.

8.2.3 Water Quality Based on FERC Relicensing Studies

YCWA is currently conducting water quality studies and analyses as part of FERC relicensing efforts for its Yuba River Development Project (FERC No. 2246). The data collected as part of relicensing provides substantive detail on baseline water quality conditions, and associated ongoing water quality monitoring further increases the accuracy and specificity of the baseline data. As described below, the extraordinary research, data, and analyses have contributed significantly to understanding of water quality conditions within the Yuba River. Relicensing studies and analyses were recently completed for two additional hydroelectric projects in the upper reaches of the Yuba River: Drum-Spaulding Hydroelectric Project[8] and the Yuba-Bear Hydroelectric Project.[9]

Yuba's 2010 IRWMP planning grant application identified the studies conducted for relicensing as particularly relevant due to their focus on three of Yuba's primary issues: water quality, fish survival, and mercury levels and abatement.

8.2.4 Groundwater Quality, Imported Water Quality, and Water Quality from Storage Facilities

8.2.4.1 Groundwater Quality

Groundwater quality data have been collected in the Yuba County IRWMP region since 1965 in selected wells from both subbasins. In 2006, an extensive study of groundwater quality in the Middle Sacramento Valley was conducted by the US Geological Survey (USGS), as part of the California Groundwater Ambient Monitoring and Assessment (GAMA) program. The GAMA Priority Basin Assessment project

[6] Davis et al. , State Water Resources Control Board, Surface Water Monitoring Program (2010). http://www.waterboards.ca.gov/water_issues/programs/swamp/

[7] May et al. (1999). http://www.fda.gov/Food/FoodborneIllnessContaminants/ChemicalContaminants/ucm194482.htm

[8] PG&E, Draft Environmental Impact Statement for the Drum-Spaulding Project (P-2310-173) and Yuba-Bear Hydroelectric Project (P-2266-096) (2013). http://www.ferc.gov/industries/hydropower/enviro/eis/2013/05-17-13.asp

[9] Nevada Irrigation District, Draft Environmental Impact Statement for the Drum-Spaulding Project (P-2310-173) and Yuba-Bear Hydroelectric Project (P-2266-096) 2013. http://www.ferc.gov/industries/hydropower/enviro/eis/2013/05-17-13.asp

was developed in response to the Groundwater Quality Monitoring Act of 2001 and was conducted in cooperation with the SWRCB.

Samples were collected from 108 wells in Butte, Colusa, Glenn, Sutter, Tehama, Yolo, and Yuba Counties. The groundwater samples were analyzed for a large number of synthetic organic constituents (volatile organic compounds [VOCs], gasoline oxygenates and degradates, pesticides and pesticide degradates, and pharmaceutical compounds), constituents of special interest, inorganic constituents (nutrients, major and minor ions, and trace elements), radioactive constituents, and microbial indicators. Most constituents that were detected in groundwater samples were found at concentrations below drinking-water thresholds. VOCs were detected in less than one-third, pesticides and pesticide degradates in just over one-half of the grid wells, and detections of these constituents from all wells of the Middle Sacramento Valley study unit were below health-based thresholds. All detections of trace elements in samples from Middle Sacramento Valley grid wells were below health-based thresholds, with the exceptions of arsenic and boron.

Arsenic was detected at concentrations greater than the regulatory MCL benchmark of 10 micrograms per liter in 22 percent of the primary aquifers in the Middle Sacramento Valley study unit, a higher proportion than what was observed in the Southern or Northern Sacramento Valley study units. High concentrations of arsenic were found in wells located along the Sacramento and Feather Rivers, likely because geochemical conditions in the sediments favor arsenic solubility. These trace and minor elements naturally occur in the region.[10]

This study did not attempt to evaluate the quality of water delivered to consumers; after withdrawal from the ground, water typically is treated, disinfected, or blended with other waters to maintain acceptable water quality. Regulatory thresholds apply to treated water served to the consumer, not to raw groundwater. However, to provide some context for the results, concentrations of constituents measured in the raw groundwater were compared with health-based thresholds established by the US EPA and CDPH, and thresholds established for aesthetic concerns (secondary MCLs) by CDPH.

8.2.4.2 Imported Water

No water is imported to the Yuba County IRWMP region from outside basins, although California relies on water exported from the Yuba watersheds. There are some interbasin transfers within the Yuba County IRWMP region, discussed in Chapter 7 *Water Supply*.

8.2.4.3 Water from Storage Facilities

Upper elevation reservoirs in the Yuba County IRWMP region are used for consumptive, irrigation, hydroelectric generation, environmental/beneficial uses, and recreation. Water quality in these storage reservoirs is considered good. The network of water supply and distribution is developed and maintained by various agencies including YCWA, PG&E, Nevada Irrigation District, Feather River Water and Power Authority, North Yuba Water District, and other smaller irrigation districts. Presently there are no known threats to water quality in the existing storage systems; however, as discussed above, there are a number of water bodies in the Plan area classified as impaired because they are unable to support certain designated beneficial ecosystem functions.

[10] US Geological Survey and California State Water Resources Control Board, Groundwater Quality in the Middle Sacramento Valley, California 2011 Fact Sheet by George L. Bennett, V, Miranda S. Fram, and Kenneth Belitz (2011).

8.2.5 Wastewater and Recycled Water Quality

Beale Air Force Base Wastewater Treatment Plant is a secondary bio-filtration process that treats an average of 330,000 gallons per day. Beale AFB no longer has a National Pollutant Discharge Elimination System permit for surface water discharge, and the effluent discharges via land to either the Base's 120-acre golf course, or its two irrigation fields. Beale AFB uses secondary-23 disinfected recycled water to irrigate the Base's golf course. The golf course is operated as a restricted-access golf course and historical irrigation demand is about 100 million gallons per year.

The City of Wheatland and Olivehurst Public Utility District (PUD) are interested in exploring the development of recycled water facilities, but they would require additional support staff and funding in order to determine if recycled water is a viable option.

8.3 Regulatory Compliance

8.3.1 Discharge and Basin Management Objectives

The Basin Plan water quality objectives for Yuba County IRWMP region beneficial uses establish the criteria for several water quality parameters. Both inland surface water and groundwater objectives are provided in Section 8.1.1. Beale AFB is currently treating several plumes from underground storage tanks. However, overall the water quality data collected for both surface and groundwater indicates the region is compliant with Basin Plan objectives.

8.3.2 Drinking Water Standards

The Yuba County IRWMP region sources for drinking water meet or exceed the CDPH MCLs.

8.3.3 Yuba County Groundwater Management Plan (2010) Goals and Objectives

The YCWA Groundwater Management Plan (GMP) states, "the goal of the YCWA GMP is to maintain a viable groundwater resource for the beneficial use of the people of Yuba County." The goals, objectives, and projects set forth in this IRWMP help promote the viability and maintenance of groundwater quality throughout the region.

8.4 Water Quality Protection and Improvement Needs in the Yuba County IRWMP Region

Sediment, mercury, bacterial contamination, water temperature, and prevention of aquatic invasive species are all areas of focus to ensure continued high-quality water in the Yuba County IRWMP region now and into the future. The following sections discuss these issues in further detail.

8.4.1 Future Water Quality Conditions

Population in the Yuba County IRWMP region is projected to increase over the next three decades by nearly twofold (see Chapter 7 *Water Supply* and Chapter 10 *Water and Land Use Planning*). Increased development can impact water quality both from a greater level of disturbance and general traffic, and from runoff from constructed surfaces and roads. Moreover, if the climate dries, as projected, less water will be available for dilution of pollutants and maintaining lower water temperatures, which could, in turn, increase the number of impaired water bodies. The Yuba County IRWMP region stakeholders are interested in programs that consider the link between natural resource management and protection of the region's water quality.

On the other hand, water quality concerns related to mercury should subside somewhat due to the state's new mercury control policy. Likewise, quality of agricultural return waters may improve from implementation of the ILRP.

8.4.2 Water Quality Monitoring

Current water quality monitoring activities in the Yuba County IRWMP region are conducted by DWR, local jurisdictions (e.g., water agencies, county environmental health departments), local watershed groups, conservation groups, and RCDs. The purpose and scope of these monitoring activities varies within watersheds and across the region. Governmental agencies are required to collect water quality information associated with a host of operational activities (e.g., raw water, treated water, wastewater discharge, FERC license requirements). These activities are conducted using strict protocols, and incorporate rigorous quality control and quality assurance standards.

Extensive water quality monitoring is currently performed by water purveyors in the Yuba County IRWMP region, as required by state and federal law and the FERC relicensing processes. As guided by regulations and permits, source waters, treated water, and areas near land use activities are periodically analyzed for pH, water and air temperature, dissolved oxygen, conductivity, turbidity, as well as bacterial constituents, inorganic chemical constituents, general chemical parameters, and organic chemicals, metals, and pesticides. Additionally, water purveyors are required to produce water quality reports to regulatory agencies at regular intervals. This information is available to the public as well as shared with stakeholder groups such as the Yuba RWMG.

Agricultural stakeholders in the Yuba County IRWMP region created water quality coalitions as a response to the Central Valley RWQCB's removal of an exemption for agricultural discharge in 2003. At that time, under the ILRP, the Placer/Nevada/South Sutter/North Sacramento Water Quality Coalition was formed. This coalition has spent over $1 million generated by landowner fees to perform monitoring activities and to report the analysis annually to the applicable water quality control board. The ILRP requires these agricultural coalitions to monitor discharges for legacy contaminants, metals, pesticides, and many other parameters. The areas in the Yuba County IRWMP region were found to be low-threat areas with zero exceedances found since 2003.[11, 12]

[11] Sacramento Valley Water Quality Coalition. 2011 Annual Report.
[12] Cosumnes, American, Bear Yuba, Integrated Regional Water Management Plan (2013).

8.4.3 Sedimentation and Erosion

Although sediment is a natural component of all river systems, it can present challenges to watershed management. Sedimentation can cause reduction in reservoir capacities and increased water treatment costs, and can adversely impact aquatic biota and habitat. Sedimentation is a natural process, but human activity has accelerated that process in some areas within the Yuba County IRWMP region. In general, sedimentation is increased when soil cover is reduced or eliminated. Historic mining activities, especially dredgers, created conditions where mercury-laden sediment continues to move within watersheds. High intensity forest wildfires and lack of management post-fire can result in landslides and accelerated erosion and sedimentation.

Some levels of erosion and sediment deposition are important for riverine processes, including providing substrate for spawning, and sediment for streambank and floodplain development. Active watershed stewardship is necessary to prevent sedimentation in the region from becoming problematic. Excessive sediment deposition moving through the riverine system into storage reservoirs can create high levels of turbidity, stress aquatic organisms, and reduce reservoir capacity.

8.4.3.1 Studies and Findings by Drainage

Yuba Watershed

Historic hydraulic mining involved directing high-pressure water cannons at exposures of Eocene gravel and washing the excavated sediment slurry through mercury-laden sluice boxes. Hydraulic mine tailings were conveyed into adjacent watercourses, leading to dramatic increases in sediment loads and severe aggradation. Gilbert (1917) estimated that hydraulic mining contributed approximately 682 million cubic yards of sediment to Yuba River channels. Extensive remobilization of stored hydraulic-mining sediment began as early as 1861 when severe winter storms delivered substantial volumes of sediment to the Central Valley.[13]

In 1941, the California Debris Commission built Englebright Dam to trap hydraulic-mining sediment mobilized in the Upper Yuba River watershed. The majority of the Middle Yuba River and South Yuba River channels have since recovered their pre-mining bed elevations; however, significant volumes of hydraulic-mining sediment remain stored in wide mainstem reaches and in smaller upland tributaries of these two rivers. Studies of the Yuba River and adjacent watersheds suggest that these smaller tributaries are asymptotically incising toward pre-mining channel-bed elevations; therefore, re-mobilization of hydraulic-mining sediment continues to affect sediment yields from impacted basins and contributes to lost water storage space in reservoirs.[14]

The Upper Yuba is considered a “priority watershed” for action by the state under the California Unified Watershed Assessment, due to impaired water quality. Yuba is a Category I watershed, which means it is a candidate for increased restoration activities due to impaired water quality or other impaired natural resource goals (emphasis on aquatic systems).[15] The high concentrations of suspended sediment in the Humbug Creek watershed can be attributed to abandoned mines in the Malakoff Diggings Historical

[13] James, A. Sustained storage and transport of hydraulic gold mining sediment in the Bear River. http://www.tandfonline.com/doi/abs/10.1111/j.1467-8306.1989.tb00277.x?journalCode=raag20#preview

[14] Curtis, J.A., L.E. Flint, C.N. Alpers, S.A. Wright, and N.P. Snyder, Sediment transport in the Upper Yuba River Watershed, California (2001–03), *US Geological Survey Scientific Investigations Report 2005-5246* (2006): http://pubs.usgs.gov/sir/2005/5246/.

[15] www.epa.gov/unified watershed assessment. (As reviewed September 3, 2014).

State Park, and clear-cuts on private lands.[16] Sediment loads in the Yuba watershed can also be attributed to other human activities such as past road construction associated with rural housing development, timber harvesting, and recreation.

Bear Watershed

The Bear River contains a large volume of mining sediment largely from two tributaries, Greenhorn and Steephollow Creeks. Sediment is stored in its main channel where three storage reservoirs are present. Due to its low-elevation headwaters (5,000 feet elevation), relatively low average annual discharge (around 273,000 af), and protracted sediment releases from water storage reservoirs, this sediment has not been flushed but continues to be a potential problem for fish habitat in the river.[17] The storage reservoirs have an infill of sediment which continues to increase in depth and reduce the storage capacity. In addition to sediment, the Bear River is a 303(d)-listed water body for mercury due to legacy mining practices. This high volume of mining sediment, in combination with restricting levees, has caused the Lower Bear channel to become deeply incised.[18] Additionally, the Bear River channel has not returned to pre-mining levels due to two main factors: 1) as mentioned, the Bear River headwaters are at relatively low elevations, resulting in discharges of low-to-moderate magnitude; and 2) hydraulic-mining sediment was of much larger magnitude than in other local watersheds.[19]

8.4.4 Mercury Methylation

The following section is based largely on information included in the CABY IRWMP 2014. As described in Chapter 6 *Region Description*, the two regions overlap in the upper watershed, and the following discussion concerning mercury is directly relevant to both.

Mercury contamination and attendant mercury methylation is a pervasive issue in the Yuba and Bear River watersheds.[20] Moreover, management and restoration of the Bay-Delta ecosystem is complicated by mercury contamination from historic mining sites in the Sacramento and San Joaquin River watersheds, the principal sources of fresh water for the Bay-Delta system. Mercury-laden sediment now contaminates downstream reaches of streams and rivers. A challenge to scientists and managers involved with restoration of this ecosystem is to avoid increasing exposure of biota to methylmercury, a toxic form of mercury. The methylation of mercury makes the pollutant “bio-available” and, if consumed, a neurotoxin. Methylmercury readily accumulates in organisms and biomagnifies (concentrates) in fish and wildlife at the top of aquatic food webs. Documented consequences of methylmercury pollution and consequent dietary exposure include: 1) direct adverse effects on the health of fish, wildlife, and humans; 2) contamination of fisheries resources that diminishes their nutritional, cultural, socioeconomic, and recreational benefits; and 3) socio-cultural damage to indigenous peoples who fish for subsistence.

[16] Schilling, F., State of the Yuba: an assessment of the Yuba River watershed, Nevada City: University of California (n.d.).

[17] James, L.A., Historical transport and storage of hydraulic mining sediment in the Bear River, California: A study of the timing, volume and character of hydraulic mining sediment production and channel responses to the sediment as well as present conditions, South Carolina Water Conference, University of South Carolina (1988).

[18] Eberhart, Allan, White Paper: Bear River Watershed Assessment, (2006): http://motherlode.sierraclub.org/4-BearRiver.htm.

[19] Ibid, James, L. A.

[20] Alpers, C.N., M.P. Hunerlach, J.T. May, R.L. Hothem, H.E. Taylor, R.C. Antweiler, J.F. De Wild, and D.A. Lawler (2005). Geochemical characterization of water, sediment, and biota affected by mercury contamination and acidic drainage from historical gold mining, Greenhorn Creek, Nevada County, California, 1999–2001. In *US Geological Survey Scientific Investigations Report 2004-5251, 278 p*. from http://pubs.usgs.gov/sir/2004/5251/

From 1900 to 1960, several billion cubic meters of alluvial material was dredged for gold, and millions of pounds of mercury was discharged. These alluvial "dredge fields" are generally downstream from dams on the major tributaries, including the Yuba and Bear Rivers, and are situated in floodplains that provide critical habitat to anadromous fish. Many of the dredge fields contain mercury-contaminated tailings from hydraulic-mining activities that took place further upstream before dams were constructed. Additional mercury was released in association with dredging processes at these alluvial sites. The release of mercury from gold mines in the Sierra, and the form of mercury in those mines has not been extensively studied; however, initial observations indicate that it may be more readily methylated. Elemental mercury and gold-mercury amalgam are often visible in streams draining hydraulically mined areas of the Sierra Nevada and in the dredged gold fields downstream, such as those on the Yuba River. Data concerning mercury and methylmercury in water, sediment, and biota from sites in the Bear River watershed are available online.[21, 22]

The USGS estimates that up to 8,000,000 of the 26,000,000 pounds of mercury used in the Sierra Nevada may have been "lost" during gold recovery, including during hydraulic mining. The mercury is present in the bottom of rivers and reservoirs, as well as in pits, sluices, and tunnels remaining in abandoned mine lands where it can be mobilized. It is transported by erosion and runoff as elemental mercury, in ionic form (i.e., Hg^{2+}), in dissolved form, adsorbed to particles, and as droplets of the metal.

8.4.4.1 Studies and Findings of Non-listed Sites

The following discussion is focused on watershed-level studies outside the 303(d)-listed sites.

The Nevada County RCD commissioned mercury studies through the USGS in 2001-2003 to track levels of mercury in fish on the Bear River. One of the findings is that "fish from reservoirs and streams in the Bear-Yuba watersheds [. . .] have bioaccumulated sufficient mercury to pose a risk to human health."[23] For example, Camp Far West has a "do not eat fish advisory" for bass and catfish (see http://oehha.ca.gov/fish/so_cal/campfarwest.html).

The USGS and others are conducting measurements of mercury and methylmercury in the biota, sediments, and waters in reservoirs and near/within abandoned mine lands of the Yuba and Bear systems. Currently, there are no direct measurements being conducted for the atmospheric deposition of mercury; however, mercury can originate from the atmosphere and this form of mercury can become bioavailable. Only a few measurements exist for the waters and sediments of the Upper Bear and Yuba Rivers and their tributaries. Though research is limited, it is known that mercury is leaking gradually from abandoned mine tunnels, sluice boxes, and pits. Dredge tailings are thought to be a potential hotspot, as is sediment disturbance during secondary mining near abandoned mine features, or in contaminated sediments. Mercury is assumed to be slowly migrating downstream in the creeks and rivers, temporarily lodging in the benthic sediments and pockets in the channel bedrock.[24]

[21] USGS, Bear-Yuba Watersheds Interagency Abandoned Mine Lands Project Bear-Yuba Watersheds Interagency Abandoned Mine Lands Project (2011). http://ca.water.usgs.gov/mercury/bear-yuba/

[22] J.G. Wiener, C.C. Gilmore, and D.P. Krabbenhoft, Mercury strategy for the Bay-Delta Ecosystem: a unifying framework for science, adaptive management, and ecological restoration. La Crosse, Wisconsin: University of Wisconsin (2003).

[23] Alpers, C.N., M.P. Hunerlach, J.T. May, and R.L. Hothem, Mercury Contamination from Historical Gold Mining in California, Fact Sheet #: 2005-3014 Version 1.1. US Geological Society, Sacramento, CA (2005): http://pubs.usgs.gov/fs/2005/3014/fs2005_3014_v1.1.pdf

[24] F. Schilling (n.d.), State of the Yuba: an assessment of the Yuba River watershed (Nevada City: University of California, Year to come).

8.4.5 Other Contamination

Non-sediment, non-mercury contaminants in the Yuba County IRWMP region potentially include microbes and biological contamination. Possible sources of these pollutants can include recreation, agricultural discharges and practices, stream and bank alterations, illegal dumping, timber harvest, and wildlife.[25]

Increasing development and the conversion of lands to impervious surfaces can also result in pollutant spikes during storm events.[26] Extreme runoff from urban areas results in unnatural flow surges and carries hydrocarbons, bacteria, lawn chemicals, and a host of other pollutants to the river systems.

8.4.5.1 Studies and Findings on Other Contaminants

Identifying sources and management strategies regarding biological contamination requires more research, especially as recreational use increases. Recently the Tahoe National Forest conducted environmental analyses to determine the effects of motorized vehicle use on National Forest System lands, and they developed guidelines for that use.[27, 28] Creating public awareness and providing education for land use best management practices can help prevent biological contamination.

8.4.6 Water Temperature

The following section is based in part on information included in the CABY IRWMP. As described in Chapter 6 *Region Description*, the two regions overlap in the upper watershed and some of the following general discussion concerning temperature holds true for both regions. The more specific information is based on relicensing data from the Yuba Development Project.[29]

Water temperature is an important water quality parameter in the Yuba County IRWMP region. Water temperatures can affect aquatic ecosystems by altering the water's ability to hold essential and beneficial dissolved gases (such as oxygen) in solution, as well as affecting mercury methylation, as mentioned above, and the hospitability of the water body to exotic species such as invasive mussels. Water temperatures may be influenced by dams, releases of surface water from reservoirs, water diversions and in-stream flows, riparian canopy, and could be affected by alterations of temperature and precipitation associated with climate change.

8.4.6.1 Studies and Findings on Temperature

In California, the timing and amounts of water released from reservoirs and diverted from streams are legally regulated with consideration of their effects on various native aquatic species, especially those listed as threatened or endangered under the Federal and California Endangered Species Acts, and additional designated species of regulatory concern. These include winter-run and spring-run Chinook

[25] Black & Veatch Corporation and Standish-Lee Consultants, Watershed sanitary survey update and source water assessment, Sacramento, CA, Black & Veatch Corporation (2002).

[26] Schmitt, J. and A. Michael, Rainfall infiltration under urban soil surface conditions – experiment and model results, 13th Annual Soil Conservation Organization Conference: Conserving Soil and Water for Society: Sharing Solutions (Brisbane: July 2004).

[27] Eldorado National Forest, Motorized Vehicle Use EIS (2008).

[28] Tahoe National Forest, Motorized Vehicle Use EIS (2010).

[29] Yuba County Water Agency, Relicensing Studies (2009). http://www.ycwa-relicensing.com/FERCApproved%20Studies/Forms/AllItems.aspx

salmon, Coho salmon, coastal and Central Valley forms of steelhead, and rainbow trout. Conversely, some amphibians require a different water temperature than those identified as ideal for salmon and steelhead. California constitutes the warm, southern end of the geographic range of most of these species. By 2100, climate change is expected to cause a considerable rise in average air temperature, raise water temperatures, greatly reduce snowpack volume, and shift the seasonal pattern of surface-water runoff to more in winter and less in spring and summer. These physical changes are likely to influence water temperatures and thus the ecology of aquatic life in the region. In many low- and middle-elevation California streams today, summer temperatures often come close to the upper tolerance limits for cold-water species, such as salmon and trout. Thus, anticipated climate change effects may be enough to raise water temperatures above the tolerance limits for salmon and trout in many streams, favoring instead non-native fishes such as carp and sunfish.[30] Chinook salmon and steelhead, for example, prefer temperatures of less than 68°F in mountain streams, although they may tolerate higher temperatures for short periods.[31]

On the South and Middle Yuba Rivers, low flows, high water temperatures, and sediment have contributed to problems for the cold-water adapted aquatic communities.[32] [33] SYRCL has over 20 temperature loggers established and takes monthly samples at 35 locations in the Yuba watershed. Additional samples are being collected by Sierra Streams Institute, Wolf Creek, and others. During spring and summer storm events, when water spills from the top of reservoirs in the Yuba River watershed, water temperatures have been shown to increase immediately downstream. Maps regarding temperature modeling along the Yuba River, completed by YCWA for its FERC relicensing process, are available in a final, and updated, report.[34] The maps completed as part of this data collection and reporting display the changes this hydropower system has had on lowering average summer temperatures due to reservoir releases. Reservoir operations can change the habitat suitability for endemic species in the area and are therefore considered in project management and licensing.

8.4.7 Aquatic Invasive Species

Aquatic invasive species (AIS) include water hyacinth and hydrilla, the bullfrog, New Zealand mudsnail, rock snot, giant reed, perennial pepperweed, parrotfeather, Eurasian watermilfoil, Brazilian waterweed, wild turkey, blue gill, crappie, yellow perch, largemouth bass, smallmouth bass, and striped bass. Additional invasion from quagga mussels, Asian clam, and other exotic species is anticipated without extreme vigilance from aquatic managers and the public. Threats from aquatic invasives are particularly insidious because of the interconnections between stream systems, and thus the ability for invasives to spread quickly.

[30] California Department of Water Resources, Progress on Incorporating Climate Change into Planning and Management of California's Water Resources; Technical Memorandum Report. Sacramento, CA, DWR (2006).
[31] Moyle, Inland fishes of California. Merced, CA, University of California Press (2002).
[32] Schilling, F., State of the Yuba: an assessment of the Yuba River watershed. Nevada City, CA, University of California (n.d.).
[33] Upper Yuba River Studies Program Study Team, for DWR, Upper Yuba River Watershed Chinook Salmon and Steelhead Habitat Assessment (June 2006).
[34] YCWA. 2009. Relicensing Studies. http://www.ycwa-relicensing.com/FERCApproved%20Studies/Forms/AllItems.aspx

8.4.7.1 Studies and Findings on Invasive Species

AIS in the Yuba County IRWMP region

Parrotfeather milfoil (Myriophyllum aquaticum) is present in the lower Yuba[35] and water hyacinth and hydrilla remain persistent problems in certain areas.

AIS in California and Adjacent Watersheds

Hundreds of AIS have found their way into California waters via transoceanic ships, aquaculture, the aquarium trade, the bait industry, recreational activities, biological research, environmental restoration projects, and through freshwater deliveries up and down the state. Nationwide, non-native species have contributed to 68 percent of the fish extinctions in the past 100 years and the decline of 70 percent of the fish species listed under the Federal Endangered Species Act.[36]

8.4.8 Wildfire and Water Quality

Up to two-thirds of Yuba County is exposed to increased fire risk from May through October annually. Increased fire frequency and intensity can impact vegetative species composition, especially the size and extent of old-growth forest habitat and related fauna; threaten critical facilities located in fire-prone areas; and increase chances for human and economic loss due to development in fire-prone areas. Reservoir water quality could also be adversely affected by increased erosion post-fire.[37]

[35] South Yuba River Citizen's League, pers. comm. (2014).
[36] Wilcove, et al., Quantifying threats to imperiled species in the United States (1998).
[37] Matyac, Scott, pers. comm. with Karen Quidachay (December 2013).

Chapter 9 *Flood Management*

9.0 Introduction

The watersheds of the Feather, Yuba, and Bear Rivers are capable of generating rapid and extreme peak flows during certain Pacific storm events from the southwest that bring high winds and torrential rains (Kelley 1989), especially when combined with large snowmelt volumes from high elevations of the Sierra Nevada. This weather pattern can result in extensive and persistent flooding in the Yuba County IRWMP region. Flooding occurs in many forms in Yuba County: *riverine*, *urban,* and *flash* flooding. The best known causes of flooding result from excess rainfall or snowmelt, especially for riverine or flash flooding, but other causes include dam or levee failure, or in the case of urban flooding, a storm drainage system overload (Yuba County Hazard Mitigation Plan 2009).

Flooding and flood management have been identified as major issues by stakeholders in the Yuba County IRWMP region, especially in the valley where most of the region's population resides and where agricultural production is vulnerable. Flooding has been recurrent and often extensive, and has had significant social and economic impacts, including loss of life, property damage, and loss of economic production. This chapter examines the history of regional flooding, flood management infrastructure, the multi-purpose and multi-jurisdictional planning undertaken to address regional flooding, and the social and economic impacts of regional flooding.

9.1 Yuba County IRWMP Region Flood Management History

The Yuba County Multi-Jurisdictional Multi-Hazard Mitigation Plan (2009) lists flooding (and attendant levee failure) as the "greatest natural disaster to the County." For centuries, developed lands along the Yuba and Feather Rivers have been subject to periodic flooding. Large floods in the Yuba County IRWMP region vicinity were frequent in the nineteenth century, with 12 high-water events recorded for the Sacramento Valley between 1850 and 1893 (Kelley 1989). Large floods continued into the twentieth century as well, including 1902, 1907, 1909, 1928, 1937, 1940, 1942, 1950, 1955, 1964, 1986, and 1997.[1] The major flood events that occurred in the last century impacted Marysville and Yuba City and low-lying valley areas below the confluence of the Yuba and Feather Rivers. The five most recent flood events and the resultant damages are described in **Table 9-1**.

[1] Draft Feather River Flood Management Plan (October 2013)

Table 9-1. Summary of Major Floods on the Yuba and Feather Rivers						
Flood Event	**Cause/Location**	**Affected Area**	**Acres Inundated**	**Number of Homes Flooded**	**Lives Lost**	**Total Damage ($ for Period)**
Nov. 1950	Training levee failure/south bank of Yuba River near Hammonton	Hammonton, Linda, and Olivehurst	43,000	Undeter mined	Undeter-mined	$4 M
Dec. 1955	Levee failure/west bank of Feather River, 3 miles south of Yuba City	Yuba City	100,000	3,300	38	$50.5 M
	Levee failure/east bank of Feather River near Nicolaus	Nicolaus	35,000	Undeter-mined	None	
Dec. 1964	High flows/Yuba and Feather River floodways	Floodway areas within levees	25,000 (within floodways)	Undeter-mined	None	$5 M
Feb. 1986	Levee failure/ south bank of Yuba River at Linda	Linda and Olivehurst	7,000	3,000	None	$450 M*
Jan. 1997	Levee failure/east bank of Feather River, 6 miles south of Olivehurst	Arboga, Linda, and Olivehurst	16,000	840	3	$150 M*

*Settlement Amounts
Source: Yuba County IRWMP 2008

Early efforts to protect nearby communities often involved the construction of levees along the major rivers. However, numerous levees failed due to greater-than-anticipated flood events, poor levee construction, insufficient levee materials, or a combination of these. Moreover, the natural flood threat was greatly exacerbated by hydraulic mining from the Gold Rush era, which sent millions of cubic yards of gravel, sand, and clay downstream to choke the channels of the Feather, Yuba, and Bear Rivers, and spread deep layers of sterile sediment over the fertile floodplains adjacent to the river channels where they emerged from the foothills.[2] This continued until January 7, 1884, when Judge Lorenzo Sawyer's decision handed down what is now known as the Sawyer Decision. This decision did not stop miners from using the big water cannons, but it did prohibit the discharge of debris in the Sierra Nevada region. It imposed strict laws regarding any debris sent downstream and it did close all loopholes. In essence, the ruling stated that "all tailings must stop."[3] Still, the accumulation of hydraulic mining debris raised the river channel bottoms and created higher floodwater stages. In 1940 and 1941, in an effort to control this mining

[2] Draft Feather River Regional Flood Management Plan (July 2014)
[3] http://malakoffdigginsstatepark.org/?page_id=568

debris, the US Army Corps of Engineers (USACE), through the California Debris Commission, constructed Englebright Dam and reconstructed Daguerre Point Dam.

The 24-foot-high Daguerre Point Dam, owned by the USACE, was built on the Yuba River in Yuba County in 1906 to prevent hydraulic-mining debris from washing into the Feather and Sacramento Rivers. The dam was equipped with two fish ladders in 1937 that, under certain flow conditions, are difficult for Chinook salmon and steelhead locating and navigating. The dam was rebuilt in 1964 following damage from floods. The dam currently provides hydraulic head for upstream diversions.[4]

In 1959, the California State Legislature enacted legislation to form the Yuba County Water Agency (YCWA) and declared flood control to be one of its principal purposes. Following state approval of water rights and feasibility studies, the citizens of Yuba County approved a $185 million bond issue by an 11-to-1 margin. The program funded by these bonds included construction of New Bullards Bar Dam and Reservoir for flood control, water supply, power development, and recreation; canal systems to deliver irrigation water; diversions from the Middle Yuba River at Our House and Log Cabin Dams through tunnels and the New Colgate Tunnel and Powerhouse; and construction of the Narrows II Powerhouse at Englebright Dam. New Bullards Bar Dam was completed in 1969.[5]

More recent major flooding events over the last 50 years demonstrate the deficiencies of current flood management infrastructure. In addition, future floods may also occur more frequently than past events due to climate change. For example, levee breaks on the Yuba River in 1986 and the Feather River in 1997 flooded large parts of the southern Yuba County area. To address these concerns, in 1997, YCWA initiated a phased approach to planning and financially supporting other local agencies to implement additional flood control measures. The Feather-Yuba region includes major streams and flood control infrastructure that span a spatially large area, and cover numerous jurisdictions at various levels of government. Effective flood management over this large and complex area requires participation and coordination between all local emergency personnel and state and federal agencies across the entire region.

9.2 Regional Flood Management Plans

To better address the regionwide flood management issues and concerns, a number of stakeholders in the Feather River Basin recently partnered with the California Department of Water Resources (DWR) to develop the Feather River Regional Flood Management Plan (FRRFMP). The FRRFMP addresses flood management for 302,000 acres of levee-protected lands within Sutter, Butte, and Yuba Counties and a small portion of Placer County along the Bear River near Wheatland. The region addressed by the FRRFMP has an estimated population of 135,300 within an area that extends about 56 miles from north to south and between 5 and 17 miles from west to east. Approximately 76 percent of the land area within the region is actively farmed agricultural land, 16 percent is native vegetation or grazing land, and 8 percent is urban and otherwise developed land. The portion of the Yuba County IRWM Plan Area that overlaps with the FRRFMP boundary represents approximately one-fifth of the total regional flood management area.

Partnering Yuba County FRRFMP stakeholders, who will communicate flooding concerns back to the RWMG, include: YCWA, Three Rivers Levee Improvement Authority (TRLIA), the Marysville Levee

[4] www.water.ca.gov/fishpassage/projects/daguerre.cfm
[5] Yuba Region IRWMP (2008)

Commission, and the Sutter Butte Flood Control Agency, which is outside the Yuba County IRWMP region. The FRRFMP incorporates the concerns and priorities of various interests in the Feather River Basin, including local Levee Maintaining Agency representatives, elected officials, property owners, businesses, interested individuals, small community representatives, Native American Tribes, and non-governmental organizations.

The FRRFMP establishes the flood management priorities of the Feather River Basin and is intended to facilitate future funding and implementation of much-needed flood risk reduction projects throughout the basin. This regional approach allows for improved coordination with state and federal agencies in the planning and implementation of flood management strategies, which increases the local benefit of program implementation while reducing local cost share.

The FRRFMP is currently in progress, and the latest Final Draft version was posted to the document website in August 2014. The FRRFMP is designed in accordance with the recently adopted 2012 Central Valley Flood Protection Plan (CVFPP), which provides a broad vision to manage flood risks in the Central Valley and to guide regional- and state-level financing plans for investments which are anticipated in the range of $14 billion to $17 billion over the next 20 to 25 years. The CVFPP proposes a system-wide investment approach for sustainable, integrated flood management in areas currently protected by facilities of the State Plan of Flood Control (SPFC). The CVFPP will be updated every five years, with each update providing support for subsequent policy, program, and project implementation. The FRRFMP is designed to inform the 2017 Five-Year Update of the CVFPP with more detailed information about the needs of the Feather River Basin.

The objectives of the regional (Feather River Basin) planning process are founded on, and consistent with, the goals of the 2012 CVFPP as described below:

Primary Goal of the Regional Flood Management Plan

Improve Flood Risk Management – Reduce the chance of flooding, and damages once flooding occurs, and improve public safety, preparedness, and emergency response through the following:

- identifying, recommending, and implementing structural and nonstructural projects and actions that benefit lands currently receiving protection from facilities of the SPFC; and
- formulating standards, criteria, and guidelines to facilitate implementation of structural and nonstructural actions for protecting urban areas and other lands of the Sacramento and San Joaquin River basins and the Delta.

Supporting Goals

- Improve operations and maintenance
- Promote ecosystem functions
- Improve institutional support
- Promote multi-benefit projects

This chapter is based largely on information from the Draft Final FRRFMP (August 2014) and the 2012 CVFPP. The reader is referred to the FRRFMP for extensive information on flood management regulatory agencies, relevant laws and regulations, and detailed descriptions of flood operations and infrastructure in the entire Feather River basin. The most recent version of the Plan can be found at http://frrfmp.com/documents/.

As summarized in the FRRFMP (2014), there are several important connections between flood management and water quality:

> "*Most importantly, floods are capable of mobilizing enormous sediment loads and any included contaminants, carrying them downstream, and then sorting and re-depositing them. The rivers and streams of the region were heavily impacted by gold mining in the Feather, Yuba, and Bear River basins. As a result, large amounts of mercury were released into the stream system, mainly due to its use in capturing gold from sluice boxes during the Gold Rush. Mercury poses major obstacles to sediment management and ecosystem restoration where it occurs in large concentrations. The potential for mobilization of mercury is a consideration for any channel modification or levee construction project in the region.*
>
> *When levees fail, the inundation of homes, farms, businesses, and industries often results in the release and dispersion of highly toxic chemicals, which can have far reaching health and economic effects. All of these water quality concerns will continue to affect flood management programs by requiring that contaminants and toxics be addressed in the planning, design, construction, and maintenance phases of flood management projects, most likely intensifying in the future*."

9.3 FEMA Floodplain Mapping in the Region

Mapping of the Yuba County IRWMP region's floodplains has proven to be expensive, political, and controversial. When the Federal Emergency Management Agency's (FEMA's) National Flood Insurance Program (NFIP) was first established in 1968, areas protected by USACE levees were presumed to meet 100-year criteria (a 100-year flood is one that has a one percent chance of reaching a certain flood stage in any given year). As a result, most of the floodplains in the region protected by the levees of the SPFC were mapped with 100-year ratings. High flows and levee failures during February 1986 and again in January 1997 led to recognition that the levee system may provide less than 100-year protection, particularly in the Sacramento area, where portions of the levee system were de-certified, and the floodplain was re-mapped as a high-hazard area.

FEMA is currently working nationwide to re-map levee-protected regions across the country, using current engineering standards and data. The net effect in many areas, including the Yuba County IRWMP region, will be de-certification of levee systems previously deemed adequate. The revised flood hazard ratings will in turn have significant economic impacts on affected areas, due to increased flood insurance costs, limitations on economic development, and the need to fund additional levee improvements.

The State of California has also set its own new standards for floodplain mapping with the passage of Senate Bill 5 in 2007. Senate Bill 5 sets 200-year flood protection as the minimum standard for urban areas, which is a significant increase over the 100-year level of protection required by FEMA. According to the FRRFMP 2013, these increasingly stringent standards create a difficult challenge for rural areas, including most of the Yuba County flood management areas, in that there are a multitude of levee sites which need to be repaired to restore the historic design function. The new standards, largely established to meet urban requirements, would result in repairs which are too expensive for the rural levee maintaining agencies to afford. The region is supportive of current efforts by DWR to work with the flood

management community to develop rural levee repair standards that will facilitate affordable repairs of multiple sites.

DWR has completed three selected special studies to support floodplain evaluation and delineation. Example studies include:

- Sacramento and San Joaquin River Basins Comprehensive Study (2002): This study was a joint effort by the State of California Reclamation Board and USACE in coordination with federal, state, and local agencies. It provides a Comprehensive Plan for Flood Damage Reduction and Ecosystem Restoration within the two river basins, and a strategy for implementation. Numerous technical analyses were performed for this study using computer modeling tools developed by the USACE and DWR to simulate the hydrology, hydraulics, ecosystem function, flood risk, and associated economic damages in the Sacramento and San Joaquin River systems. DWR, USACE, and others will use these models in developing future flood management and environmental improvement projects in the Sacramento and San Joaquin River basins.
- The Upper Feather River Floodplain Mapping Study (2002, updated 2008): DWR commissioned USACE to prepare a floodplain mapping study along the Feather River. The study extends from the mouth of the Yuba River upstream to Oroville Dam, approximately 44 miles in length. The study delineates the 100-, 200-, and 500-year floodplains along the Feather River between the Yuba River and Oroville Dam.
- The Lower Feather River Floodplain Mapping Study (2005): DWR commissioned USACE to prepare a floodplain mapping study along the Lower Feather River. This study addresses flooding from the Feather River downstream from the Yuba River confluence to the mouth of the Feather River at Sacramento River. It also addresses flooding from the Bear River downstream of Highway 65 and several tributaries to the Bear River.

Relevant agencies will be delineating the 200-year floodplain within Yuba County, and the results of that mapping will be included in future updates of this IRWMP.

9.3.1 Flood Insurance Costs

Even more controversial than floodplain mapping for landowners in the Yuba County IRWMP region, both FEMA and USACE have implemented policies and programs that will likely result in increasing the cost of mandatory flood insurance policies for floodplain homes and businesses and increasing the cost of repairs after a levee failure. For example, FEMA's flood risk map digitizing and risk reassessment efforts will result in re-mapping of much of the region as providing less than 100-year flood protection. As a result, development in these areas will be more expensive, difficult to insure, and subject to flood-proofing or elevation requirements.

In July 2012, the United States Congress passed the Biggert-Waters Flood Insurance Reform Act of 2012 (BW-12), which calls on FEMA and other agencies to make a number of changes to the way the NFIP is run. This Act would result in significant insurance rate hikes for many landowners in the Yuba County IRWMP region. The Biggert-Waters law was intended to help reduce the debt of the NFIP, a debt now estimated at more than $25 billion, by bringing rates more in line with the risk and losses in flood-prone areas. Recent legislation passed in 2013 calls for a four-year delay in most rate increases and requires FEMA to complete an affordability study and propose regulations that address affordability issues. Another problem with FEMA's NFIP rates is they are based on damages that would be expected in a riverine flooding environment and do not consider the benefit that existing uncertified levees provide.

This results in NFIP insurance rates that over-predict the probability of a property experiencing a claim and therefore set a higher rate than a true actuarial rate would require.

9.4 Overview of Yuba County IRWMP Region Flood Management

Snowmelt flows by themselves and without a rain-flood increment generally do not present a flood threat to the downstream areas because the river channels have the capacity to safely pass flows far in excess of the maximum historical snowmelt. Similarly, longer duration storms or a storm sequence can be more easily controlled by the basin reservoirs in combination with the large channel capacities within the leveed channels.[6]

In contrast, the flood-producing storms are generally of relatively short duration (two to five days) with an occasional longer storm that follows. The Yuba and Feather Rivers have a "flashy" hydrograph that quickly responds to storm events—the rivers quickly rise and recede in the upper watersheds and canyons. For example, during the January 1997 flood, inflow to Lake Oroville increased tenfold—from about 30,000 cubic feet per second (cfs) on December 29, 1996, to 300,000 cfs on January 1, 1997. The following sections present an overview of the flood management infrastructure, systems, and challenges in the region as well as opportunities for improvement as outlined in the FRRFMP.

9.4.1 Flood Management Infrastructure[7]

The flood management infrastructure that currently provides protection to the Yuba County IRWMP region includes upstream reservoirs with active flood control space, levees along the major flood control channels, and drainage facilities that pump interior runoff and seepage from levee-protected areas back into the flood-control channels. These facilities are part of a vast system of multipurpose reservoirs, leveed stream channels, weirs, and overflow structures constructed to reduce flooding in the Sacramento Valley over the past 160 years.

Reservoirs in the region with an active flood control function include Lake Oroville on the Feather River, operated by DWR, and New Bullards Bar Reservoir on the Yuba River, operated by YCWA. Camp Far West Reservoir on the Bear River, operated by South Sutter Water District, does not provide any dedicated flood control storage and is typically full and spilling during flood events. However, the existence of the water supply facility does serve to attenuate a portion of the peak flow as it passes through the reservoir.

Most of the populated valley areas are surrounded by an extensive levee system, maintained by independent local levee districts and reclamation districts, and overseen by USACE and the Central Valley Flood Protection Board. Much of the floodplain areas of the Yuba County IRWMP region are protected by SPFC levees. Levees along the Feather, Yuba, and Bear Rivers were authorized for federal construction as part of the Sacramento River Flood Control Project in 1917.[8] In the northern part of the region, this includes levees along Honcut Creek and the Feather River. Both banks of the Yuba River have levees from

[6] Yuba Region IRWMP (2008).
[7] This section is based largely on information from the Draft Feather River Management Plan (October 2013) and Yuba County IRWMP (2008).
[8] Flood Operations Branch Fact Sheet, Sacramento Flood Control Project Weirs and Flood Relief Structures, DWR (2010).

the confluence with Feather River to high ground along the Gold Fields. The City of Marysville is protected by a ring levee around the entire city. Levees are present along the entire left bank of the Feather River between the Yuba and Bear Rivers. This levee continues along the right bank of the Bear River upstream to the Western Pacific Interceptor Canal (WPIC) that drains to the Bear River and along Dry Creek.

Within Yuba County, levee maintenance is the responsibility of the Reclamation Districts (RDs) shown on **Figure 9-1**.[9] Reclamation District 10, located along the eastern bank of the Feather River between Honcut Creek and the City of Marysville was created by a special act of the California State Legislature on August 10, 1913. RD No. 784 was formed under general RD laws on May 6, 1908, and is located east of the Feather River south of the City of Marysville. RD No. 817, along the north bank of the Bear River east of the WPIC was formed under general reclamation laws on November 4, 1910. RD No. 2103, generally between the right bank of the Bear River and Dry Creek, is east of RD 817. Both RD 817 and RD 2103 are either located within or portions at least border the City of Wheatland Sphere of Influence.

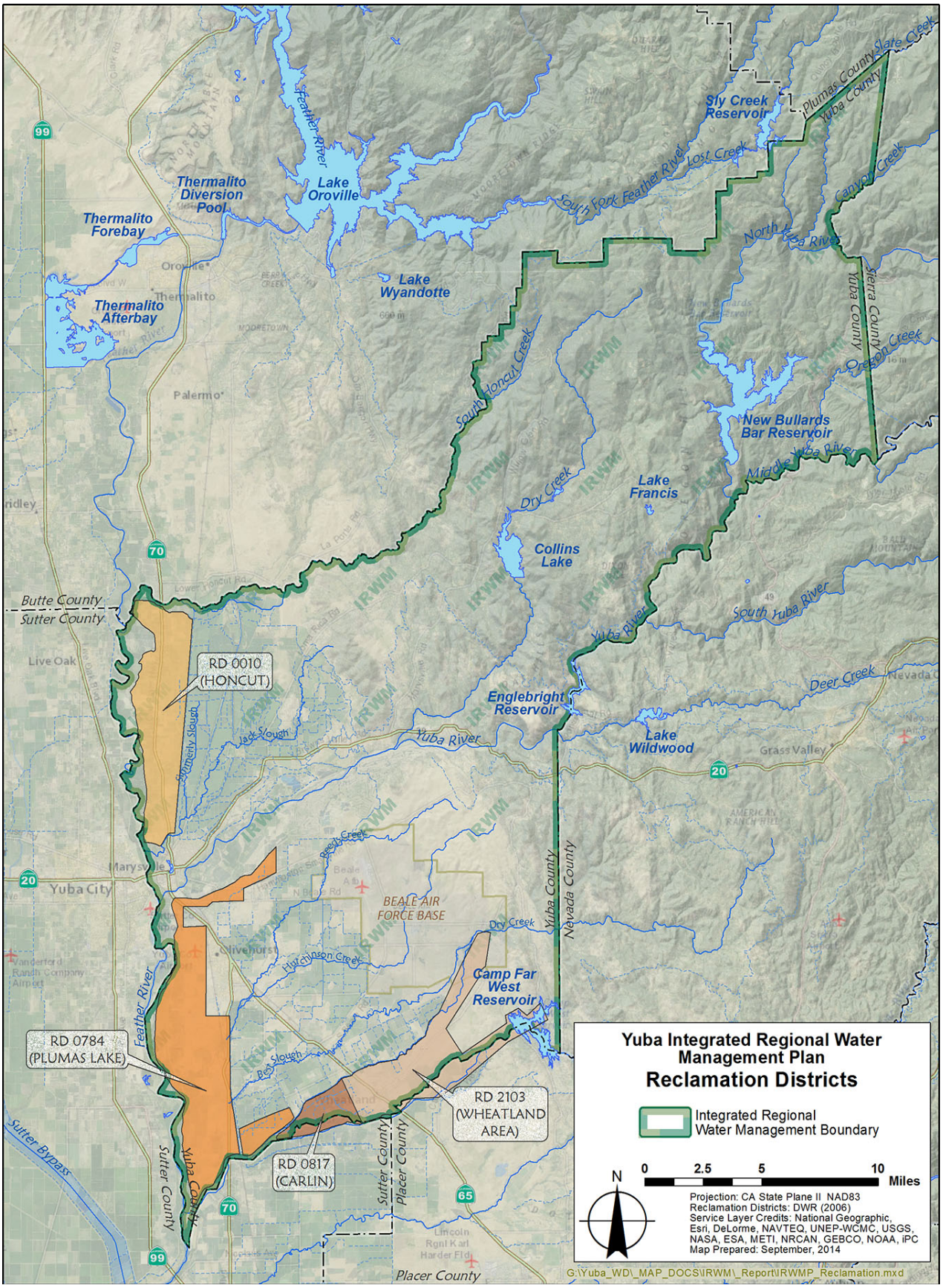
Table 9-2. Local Maintaining Agencies for State Plan of Flood Control Levees in the Yuba County IRWMP Region[10]

Local Maintaining Agency	County	Streams	Square Miles
Reclamation District No. 10	Yuba	Feather River and Honcut Creek	21.93
Reclamation District No. 784/Plumas Lake	Yuba	Yuba River LB, Feather River LB, Bear River RB, Dry Creek RB and Western Pacific Interceptor RB and LB Canal, plus 60 miles of ditches, canals, detention basins	38.43
Reclamation District No. 817, Carlin	Yuba	Bear River RB and Dry Creek RB and LB	9.19
Reclamation District No. 2103, Wheatland Vicinity	Yuba	Bear River RB and Dry Creek LB	9.77
Marysville Levee District	Yuba	Feather River LB, Yuba River RB, and Jack Slough LB	11.38

Source: FRMP 2013
Maintenance provided by the Sutter Maintenance Yard, DWR
DWR 2010 Inspection Report of the Central Valley State-Federal Flood Protection System
LB= left bank, RB=right bank, when looking downstream in direction of flow

[9] Yuba County IRWMP (2008).
[10] Feather River Regional Flood Control Plan

Figure 9-1


Yuba Integrated Regional Water Management Plan
Reclamation Districts
Integrated Regional Water Management Boundary
0 2.5 5 10 Miles
N
Projection: CA State Plane II NAD83
Reclamation Districts: DWR (2006)
Service Layer Credits: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC
Map Prepared: September, 2014
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RD 0010 (HONCUT)
RD 0784 (PLUMAS LAKE)
RD 0817 (CARLIN)
RD 2103 (WHEATLAND AREA)
Lake Oroville
Thermalito Diversion Pool
Thermalito Forebay
Thermalito Afterbay
Lake Wyandotte
Sly Creek Reservoir
New Bullards Bar Reservoir
Lake Francis
Collins Lake
Englebright Reservoir
Lake Wildwood
Camp Far West Reservoir
BEALE AIR FORCE BASE
Feather River
South Fork Feather River
North Yuba River
Middle Yuba River
South Yuba River
Yuba River
South Honcut Creek
Dry Creek
Deer Creek
Oregon Creek
Canyon Creek
Lost Creek
Slate Creek
Plumas County
Yuba County
Sierra County
Butte County
Sutter County
Nevada County
Placer County
Sutter Bypass
Yuba City
Marysville
Live Oak
Palermo
Oroville
Thermalito
Grass Valley
Nevada City
Beale Air Force Base
Lincoln Rgnl Karl Harder Fld
Vanderford Ranch Company Airport
Jack Slough
Hutchinson Creek
Bear Slough
Wheatland
Olivehurst
Ridley
Lower Honcut Rd
La Porte Rd
Oak Bend Rd
Dry Creek Rd
Hwy 99
Hwy 70
Hwy 20
Hwy 65

9.4.2 Flood Management Systems

The Yuba County IRWMP region flood management system is operated to safely convey flood flows through the coordinated efforts of local, state, and federal agencies. Flood control system operations include the operation and maintenance of the multipurpose reservoirs protecting the region; operating and maintaining the levee system; hydrologic monitoring and flood forecasting; and coordinated flood operations under the Standardized Emergency Management System.

Non-structural flood risk management elements include a wide range of measures that limit the risk of flood damage primarily by avoiding or reducing the exposure to damaging flood waters rather than by confining those flood waters with larger and stronger hydraulic structures. These elements include raising and waterproofing structures so that they will be above anticipated flood levels or unharmed by flood waters, purchasing and relocating at-risk structures, limiting development in floodplains through the acquisition of agricultural conservation easements, establishing open space easements, regulatory constraints, and incentive programs. Restoration of floodplains where feasible, to provide additional flood channel storage and conveyance capacity, is often regarded as a non-structural element because it reduces rather than increases the confinement of floodwaters in existing channels.

9.4.3 Flood Management Channel Capacities

Approximately 45 percent of the average annual runoff occurs in the rain- and flood-producing months of December through March; about 35 percent of the runoff is generated in the snowmelt months of April through June, although earlier snowmelt has been documented in recent decades as the climate warms. Levees are designed to provide specific channel capacities. The design flows for various locations are shown in **Table 9-3**.

Table 9-3. US Army Corps of Engineers Flood System Design Flows[11]

Location	Design Flow, cfs
Feather River at Yuba City	210,000 cfs
Yuba River at Marysville	120,000 to 180,000 cfs*
Feather River below the Yuba River	300,000 cfs
Feather River below the Bear River	320,000 cfs
Bear River below WPIC	40,000 cfs

*Combined Feather River and Yuba River flows should not exceed 300,000 cfs.

The combined capacity of the channels of the Feather and Yuba Rivers upstream of the mouth of the Yuba River can safely carry more water than the Feather River channel downstream of the Yuba River. The flood system downstream of the Yuba is constrained by the limited channel capacity of the Feather River. Similarly, the combined design capacity of the Feather River and Bear River could exceed the capacity of the Feather River below the Bear River. However, the peak flows in the Bear River normally

[11] Yuba County IRWMP (2008)

occur earlier than the peak flows in the Feather River. Exceeding the Yuba channel capacity can be an issue because the Middle Yuba and South Yuba are uncontrolled rivers for flood management purposes.

9.4.4 Summary of Flood Management Challenges and Opportunities

The following excerpt from the FRRFMP makes clear the existing challenges with the Yuba County IRWMP region's existing flood management systems.

> *Broadly stated, the levees that were originally constructed to protect largely agricultural areas are inadequate to protect developing areas. Although the regional flood management system has prevented millions of dollars in flood damages since its construction, a better understanding of the risk assessment and engineering standards has made it clear that some of the regional levee segments face an unacceptably high chance of failure. This, combined with growth in the region has increased the estimated level of flood risk. While the chance and frequency of flooding has decreased since construction of the region's levees and multipurpose reservoirs, the damages that would occur if a levee were to fail in one of these areas are much greater, resulting in a net long-term increase in cumulative damages if no further action is taken to improve the flood management system or to limit further development in these areas.*

The multitude of state and federal agencies, programs, policies, and procedures profoundly affect how future regional flood management elements are designed, financed, and constructed, how the system is operated and maintained, and how the economic stability and environmental quality of the region are improved over time. The specific flood management challenges in the Feather River basin are outlined in the FRRFMP as follows:

> ***Levees:*** *The regional levee system was built over many years using available materials. While substantial work has been completed to upgrade urban levees in the region, portions of the levee system suffer from structural instability, erosion, settlement, inadequately designed or decaying penetrations, excessive vegetation, rodent damage, and encroachments. Meanwhile, the number of people and the importance of the infrastructure they protect have grown tremendously, with a resultant high risk to life and property in the region. Appendix A* [in the FRRFMP] *includes a detailed discussion of the specific levee deficiencies which have been identified based on operational experience during floods and technical studies such as DWR's Urban Levee Evaluation Program and Non-Urban Levee Evaluation Program.*
>
> ***Channels:*** *Channels in the region must be managed to address the impacts of localized erosion, sedimentation, and vegetative growth, which both impedes floodwater capacity and provides critically important wildlife habitat. Improved collaboration among maintaining and regulatory agencies, combined with flood corridor planning, offers the opportunity to optimize channel benefits of flood conveyance and wildlife habitat. From a regional perspective it is critically important that flood conveyance capacity continues to be the top management priority.*
>
> ***Reservoirs:*** *Reservoirs in the region, such as Lake Oroville and New Bullards Bar Reservoir meet many important regional and [s]tate water management objectives. However, with current flood storage, release capabilities, and operational criteria, storms*

larger than the 1997 flood would likely result in flows that exceed channel capacities. There are opportunities to make both operational and structural improvements which can substantially improve their effectiveness in reducing flood risk, including structural improvements, Forecast Coordinated Operations, and Forecast Based Operations.

Fisheries and Wildlife Habitat: *Fisheries and [w]ildlife habitat have been substantially altered and degraded over the past 160 years through the construction of flood control levees, dams, and diversion structures, as well as land use changes across the region. There are opportunities to improve these habitats as part of multi-objective flood risk management projects, consistent with the goals of the CVFPP and the regional objectives. The region seeks to integrate agricultural land preservation, habitat enhancement, and restoration opportunities where feasible. The Flood Management Plan describes strategies for preserving agricultural lands along flood corridors in ways that are wildlife friendly, describes habitat enhancement and restoration opportunities, and explores environmental compliance and mitigation solutions.*

Operation and Maintenance: *Operation and [m]aintenance constraints have increased costs and made it progressively more difficult to meet levee maintenance standards. Complex, time consuming, and expensive permitting processes create hurdles for Local Maintaining Agencies which have historically had the freedom and license to clear vegetation, repair erosion sites, restore levee sections, and resurface roads from late spring through fall. The region is now working with a multitude of [s]tate and federal agencies to develop management tools and practices which can achieve both operational efficiency and flood risk management goals.*

Flood Risks and Levee Performance Evaluation: *Flood risk is the combined effect of the chance of flooding and the consequences of flooding. As development occurs within levee-protected areas, flood risk increases as well. Climate change is likely to result in more extreme rain floods, which will increase the chance of overwhelming the regional flood management system. Meanwhile, in the aftermath of major flooding elsewhere in the country, such as the 2005 flooding of New Orleans, USACE has been creating a more conservative framework for risk assessment, with the net effect of downgrading the flood protection ratings of flood protection facilities.*

9.5 Summary of Yuba County IRWMP Region Flood Impacts

According to the Yuba County *Multi-Jurisdictional Multi-Hazard Mitigation Plan* (2009) (MJMHP), roughly one-third of the county's population lives in the 500-year floodplain, along with emergency evacuation routes, sewer and water treatment plants and other infrastructure, and numerous critical community facilities. Floods in 1986 and 1997, exacerbated by levee failures on the Yuba and Feather Rivers, inundated large areas south of Marysville in the Linda and Olivehurst communities. Levees are instrumental in protecting vulnerable populations in Marysville, Wheatland, and an area of RD 10 as well. At higher elevations, damage to roadways occurred from landslides and debris flows.

The cost of flood and levee failure is estimated at over $487 million for a 100-year event and at over $648 million for a 500-year event.[12] Over four percent of all jurisdictional critical facilities are located in

[12] Yuba County Multi-Jurisdictional Multi-Hazard Mitigation Plan (2009).

the 100-year floodplain in Yuba County, while 14 percent of such facilities are exposed to 500-year events. About 15,000 people were located in the 100-year floodplain in 2000, and of these, 2,300, or 15 percent were severely disadvantaged (annual incomes under $10,000).[13] Increased potential for flood risk due to intense storm events and higher peak flows could result in loss of life, damage to critical facilities, property damage, and loss of business and tax receipts.

9.5.1 Impacts from Localized Flooding from Severe Winter Storm Events

Localized flooding from severe winter storms also occurs along roads throughout Yuba County. Several neighborhoods are prone to localized flooding during significant rainfall events. Floods also occur due to debris accumulation in storm drains and in flood control channels and basins. This is referred to as *ponding* or *urban flooding* (Yuba County 2009). The MJMHP identifies the following areas as at-risk in Yuba County due to localized flooding:

- Highway 70 at McGowan Parkway
- Hammonton–Smartsville Road at Brophy Road
- Area off Arboga Road at Buttercup and Butterfly Lanes
- Mage Avenue in Olivehurst
- Magnolia Avenue off Highway 70
- Ramirez Road
- Iowa City Road
- Fruitland Road
- Simpson Lane

The problem areas noted above are considered to be a hazard in their specific location and are not expected to threaten or endanger the lives of persons in the surrounding areas.

FEMA has identified eleven repetitive loss properties within Yuba County.[14] Nine of these properties are within Olivehurst, one is in Marysville, and one in Camptonville. These properties have been subject to repeated flooding during high water periods. The cause of most of the above properties' repetitive losses has been issues involving internal drainage.

The MJMHP states:

> *During the 2005-2006 winter season Yuba County experienced a significant storm event that caused widespread damage across the County. Documented damage assessments resulting from the storm event totaled over $5,325,000 across all of Yuba County and its special districts. Typical damage resulting from the storm included abundant damage to roadways from debris falls and slipouts, water overflow resulting in debris on the roadway, pothole damage, fallen trees, crop damage, and localized flooding of homes. Rainfall accumulations of 20 to 24 inches during the storm event in the Feather River basin make the storm event the fourth wettest December on record since 1920 (http://www.cnrfc.noaa.gov/storm_summaries/dec2005storms.php).*

[13] Yuba County Multi-Jurisdictional Multi-Hazard Mitigation Plan (2009).
[14] Ibid.

> *Other historic events, such as the 1986 severe winter storms which resulted in $95 million in losses, and the 1997 severe winter storm event which resulted in $358 million, indicate the wide range of potential losses that could result from future large storm events. Typical winter storms do not usually approach the magnitude of the 2005-2006 storm event, but the county can expect thousands to hundreds of thousands of dollars of damage each year from severe storm events. More difficult to quantify but nonetheless important is the potential loss that results from the population being unable to work because of road conditions or storm-related power outages.*

9.5.2 Impacts from Recent Major Flood Events

1986 Flood

A massive flood in 1986 triggered a levee break along the Yuba River and water quickly inundated developed areas such as Olivehurst and Linda. Flood waters were 10 feet high in some places. The MJMHP summarizes the breakout damage from the 1986 flood as follows:

> **Breakout of Damage in Dollars for the 1986 Flood in Yuba County**
> There was a total of $95,000,000 in damage to buildings, equipment, and land.
>
> **Structures:**
> 3,000+ homes damaged
> 1 death
> 10,700 acres flooded

1997 Flood

In 1997, the Arboga area was inundated by floodwaters when a levee broke on January 2 (the Country Club break). Another levee gave way three weeks later, causing additional flooding in some of the same areas (the Bear River break). These levee breaks occurred in areas scheduled for repair, having been identified as deficient following the 1986 flood (Be Prepared Yuba 2013).

The organization known as "Be Prepared Yuba" summarizes some of the impacts on their website stating:

> *Homes closest to the breaks were destroyed by the force of the rushing water, with some reports indicating flood depths of 30 feet. Farther from the levee breaks, many homes were damaged beyond repair due to water depths of 10 feet. In total, 38,000 Yuba County residents were evacuated, including almost everyone in Marysville. Three people lost their lives. Portions of the communities are still trying to recover today, more than 20 years later.*

The MJMHP summarizes the breakout damage from the 1997 flood as follows:

> **Break out of Damage in Dollars for the 1997 Flood in Yuba County:**
> There was a total of $358,637,000 in damage to buildings, equipment, and land.
>
> **Structures and Infrastructure:**
> Roads, Bridges, and Drainage - $13,077,000

Levee damage:
Reclamation Districts - $20,000,000
Marysville - $5,000,000

Residential:
Homes - $50,000,000
Mobiles - $5,000,000

Agricultural:
Buildings and Equipment - $40,850,000
Crops - $17,583,100
Livestock - $2,417,000
Nurseries - $60,000

As summarized above, floods result in significant short-term damage, but long-term economic effects are also significant. Businesses often temporarily or permanently close as a result of flood damage, causing loss of revenue and increasing unemployment. Critical facilities such as utilities (electric, telephone, water and sewer, gas/oil pipelines) and roadway and airport infrastructure are often disrupted, and the subsequent clean-up and reconstruction can take years to complete.[15]

9.6 Recent Flood Protection Efforts

Recent efforts by YCWA, Yuba County, TRLIA, RDs 784, 817, and 2103, the City of Marysville, the State of California, and USACE have greatly reduced the flood risk. The organization *Be Prepared Yub*a is a collaborative effort to assist residents to prepare for disasters. They estimate that since 2007, almost a half billion dollars have been spent on repairs to dozens of miles of levees protecting Marysville, Wheatland, Linda, Olivehurst, Arboga, and Plumas Lake. The following summary of these efforts is based on information provided on the *Be Prepared Yuba* website.

Levee System Evaluation Project

Following the 1986 flood, USACE partnered with the State of California and RD 784 and the Marysville Levee Commission in an effort to repair and strengthen levees with the "Levee Systems Evaluation Project." Despite another levee failure in 1997, the Corps maintained that the repairs would provide the much-needed flood protection. Meanwhile, DWR and the Corps initiated a study to determine the ability of the levees to withstand a 100-year flood event, a flood that has a one percent chance of occurrence in any given year. FEMA imposes development restrictions and flood insurance requirements on communities that do not provide this minimal level of protection.

The following paragraphs describe some flood control projects in the Yuba County IRWMP Region. In addition to the projects described below, RD 817 and Yuba County have invested in flood related projects at the airport and in Olivehurst and Linda. These and other proposed flood control projects are described in detail in **Appendix 14-1**.

Three Rivers Levee Improvement Authority

In 2004, Yuba County and RD 784, the agency responsible for levee maintenance on behalf of the state, created the Three Rivers Levee Improvement Authority (TRLIA). The joint powers agency was given a

[15] Yuba County Multi-Jurisdictional Multi-Hazard Mitigation Plan (2009).

mission to finance and construct levee improvements on RD 784 levees, with the goal of achieving 100-year and 200-year flood protection. System improvements began in 2004 and early public-private partnerships with local developers provided resources for the initial investment in levee improvements. By the end of 2006, significant work had been completed on Yuba River, Western Interceptor Canal, and Bear River levees.

The highlight of the initial work was the Bear River Setback Levee, considered an example of civil engineering excellence and the subject of several prestigious awards from professional engineering associations. In partnership with River Partners the project also resulted in the planting of one million shrubs and trees in the setback area, and created 600 acres of wildlife habitat benefiting several threatened and endangered species, such as Swainson's hawk and the valley elderberry longhorn beetle. The preserve provides shaded riverine aquatic habitat and valley oak riparian forest components that enhance habitat for fish species, including Central Valley salmon species and steelhead. Dense clusters of a variety of shrub species are included to support a diversity of migratory songbirds.

By late 2006, TRLIA's levee improvement program expanded to four phases covering 29 miles of levees, including 13 miles along the Feather River. In May 2008, TRLIA broke ground on the program's highly acclaimed engineering accomplishment, the six-mile-long Feather River Setback Levee, the largest of its kind in the state. Like its counterpart along the Bear River, the Feather River Setback Levee provides significant benefits for regional flood protection. In fact, it is expected to lower water levels in the Yuba and Feather Rivers by more than 1.5 feet during large flood events, taking pressure off levees in Marysville and Sutter County. The setback area, which required the acquisition of 1,600 acres of land, is being evaluated for recreational, agricultural, and environmental uses. A regional trail system may someday run along the top of the levee, much like the one along the American River in Sacramento. To date, the project has earned several awards from the American Society of Civil Engineers, and most recently the Floodplain Management Association. The Upper Yuba Levee Improvement Project was completed in October 2011.

In 2011, interest was renewed in understanding the flood risk associated with the Gold Fields. Located northeast of Marysville, the Gold Fields is a nearly 10,000-acre area that has been mined for gold and aggregate for more than 100 years. In 1950, a mining operation created a manmade breach in Yuba River south bank in the Gold Fields. A subsequent early-season, high-water event led to flooding in south Yuba County.

The Corps studied flood risk in the Gold Fields as part of its Yuba Basin Feasibility Study and concluded that the Gold Fields did present a risk of flooding to South Yuba County from a 200-year flood event, but not a 100-year event. TRLIA conducted a more detailed hydraulic analysis, the results from which are being used to make improvements and reduce the flood risk in this area.

Marysville Ring Levee Work Underway

The City of Marysville, in partnership with the Central Valley Flood Protection Board and the Corps, is constructing repairs and improvements to the 7.6-mile ring levee that surrounds the city. Although a Marysville levee has not failed in 135 years, four miles of the levee system need improvements to meet the state's 200-year levee design criteria. A four-phase, $90 million project to prevent seepage through the levee, or under-seepage below the levee, is underway with a goal for completion in 2020, depending on the level of appropriations from Congress. More than $10 million in stimulus funds approved by

Congress in 2009, and a $2 million line of credit from YCWA, helped jumpstart work on Phase I in 2010. A large share, approximately $90 million, will be covered by current and future federal funding.

Reclamation District 2103 (Wheatland)

RD 2103 maintains portions of the Bear River and Dry Creek Project levees. These levees protect the City of Wheatland and surrounding agricultural land from winter storm runoff. In 2006, problems with the Bear River levee were identified and a $14.7 million project was planned and constructed to make the needed repairs. The levee has received accreditation from FEMA as providing protection against a 100-year flood event.

Chapter 10 *Water and Land Use Planning*

10.0 Introduction

A goal of the IRWMP process is to facilitate communication between land use planners and water managers to better address coordination between land use and planning and regional water plans and issues. The IRWMP must incorporate and be consistent with local water and land use plans to encourage opportunities to implement local goals and policies.

One of the California Water Plan Update 2009 goals is to ensure water managers and land use planners make informed, collaborative water management decisions to better assure meeting California's water needs into the future, especially in the face of climate change and drought. The Department of Water Resources (DWR) also requires that the IRWMP describe the relationship between the planning fostered by the IRWMP process—in this case, the Regional Water Management Group's (RWMG's) planning efforts—and local water and land use planning. Early coordination of water and land use planning decisions is recognized as one of the best methods for meeting that future need; to that end, this chapter recognizes existing coordinated planning practices and highlights opportunities for future improved coordination.

The varying degrees of input from the Plan area's city and county land use planners, water agencies, non-governmental organizations (NGOs), and land management agencies is discussed in this chapter, and any input provided from these groups and local plans has been synthesized here.

Ninety percent of the Plan area is located within the Yuba River watershed, which extends from 60 feet elevation on the Sacramento Valley floor to 4,000 feet elevation in the foothill of the Sierra Nevada. Within this area are two distinct zones: the lower watershed on the valley floor and the upper watershed in the foothill and mountain areas. While these two zones have unique water management issues based on their geography, they are linked by shared use of the Yuba, Feather, and Bear Rivers and their tributaries.

The foothill region of the Plan area relies heavily on surface water, which accounts for 85 to 90 percent of the local consumptive use. The rural nature of much of the foothill area precludes the delivery of domestic water by municipal purveyors, but foothill communities in the Plan area, including Camptonville, Brownsville, Challenge, Dobbins, and Oregon House, are served in large part by in-stream diversions and storage facilities that have been constructed with local financing. As a result of the reliance on surface water and smaller storage facilities, water supply varies seasonally and from year to year, depending on the amount and timing of precipitation and the variable runoff. The remaining 10 to 15 percent of local water supply in the foothill region is provided by federal water facilities, groundwater wells, imports from adjacent regions, and reclaimed wastewater. Private wells in the foothill region, which account for much of the remaining water supply, are often drilled into the fractured-bedrock formations of the western Sierra Nevada. Yet these bedrock formations have little water-holding capacity and are often unreliable due to the fact that water can penetrate the rocks only through fissures. These fissures may at times intersect with larger storage areas whose capacity is unknown.

10.1 Local Planning Relationship to the IRWMP

Water management and land use planning are inherently interconnected, with activities that occur on land directly impacting the movement and quality of water within a watershed, and events or disturbances in the watershed affecting landscapes and land uses. For example, land use decisions that impact population growth (such as the approval of a new subdivision), or land use policies (such as water conservation ordinances) can impact water supply and demand. Further, other projects, such as resource extraction or land clearing for new development, can impact water quality from sedimentation and storm water runoff. Conversely, a water management decision such as the amount of water supplied to agricultural or environmental uses in a dry year, or how close to the flood line a levee is constructed, can impact events and uses on land.

Land use planning is an essential responsibility of cities and counties and is expressed through general plans that achieve community planning objectives. The Yuba County IRWM Plan Area boundary runs contiguous with the Yuba County boundary. Within the Plan area, Yuba County and the Cities of Marysville and Wheatland are the local land use planning jurisdictions. Other agencies may not conduct land-use planning, but have an impact on activities conducted there, such as the US Forest Service. Land-use planning entities also directly and indirectly impact the management of water resources through, for example, approval of development projects and long-range land planning and the implementation of resource standards or mitigation measures during timber harvests or other forest activities. Organizations whose primary purpose is to plan land uses and activities are discussed in more detail in section 10.2 of this chapter.

Water planning anticipates future supply and demand scenarios, issues, and management strategies to respond to potential issues. Water planning tasks in the Plan area are performed by water purveyors such as Yuba County Water Agency (YCWA) and California Water Service, dam operators such as Browns Valley Irrigation District and US Army Corps of Engineers, special-purpose districts such as YCWA's member units or the local reclamation districts, and in certain cases municipalities, such as the City of Wheatland Department of Public Works. NGOs such as South Yuba River Citizens League (SYRCL) and Northern Foothills Partnership, though not water purveyors, are also valuable partners in the water planning process. Yet other entities also impact the management of water resources, such as the National Marine Fisheries Service (NMFS), which has developed a recovery plan for salmon and steelhead in the Plan area that includes action items to be implemented in the Yuba River watershed (July 2014).[1]

For the purposes of this chapter, the focus will be on Plan-area water managers, though it should also be noted that entities upstream of the Plan area, including Nevada Irrigation District, South Feather Water and Power Authority, and PG&E, also have water management responsibilities that may impact the Plan area. These are discussed in more detail in Chapter 7 *Water Supply.*

Of the water purveyors in the Plan area, YCWA is the largest, delivering surface water from the Yuba River to its eight member units. Member units are Cordua Irrigation District (CID), Ramirez Water District, Hallwood Irrigation Company (HID), Browns Valley Irrigation District (BVID), Brophy Water District, South Yuba Water District, Dry Creek Mutual Water Company, and Wheatland Water District. Of these, BID, CID, and HID also hold their own appropriative rights for diversion of water from the Yuba River, and some of the member units still pump groundwater as needed. YCWA's water uses include flood control, fisheries enhancement, recreation, hydroelectric power, and storage of water for sale to its member units. In addition to the YCWA and its

[1] National Marine Fisheries Service, West Coast Region, Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the Distinct Population Segment of California Central Valley steelhead, Sacramento, California (July 2014).

member units, the following agencies provide surface water for agricultural purposes: North Yuba Water District (from south of the Feather River), Camp Far West Irrigation District (from Bear River), and Plumas Mutual Water Company (from the lower Feather River).

10.1.1 IRWMP Relation to Local Water Planning & Implementation

Numerous agencies with a legal responsibility for, or an interest in, managing water resources have generated water planning documents for the Plan area. YCWA has generated multiple planning documents, municipal purveyors have adopted Urban Water Management Plans, and many NGOs have prepared watershed management and restoration plans.

Entities with water and land use planning documents and programs used in the preparation of this IRWMP and discussed in this chapter are shown in **Table 10-1**.

Table 10-1. Water and Land Use Planning Documents and Programs in the Yuba County IRWMP Region	
Water Purveyors	**Documents and Programs**
Beale Air Force Base	▪ Air Combat Command: Installation Sustainability Assessment Report (2012)
California Water Service (for City of Marysville)	▪ Urban Water Management Plan (2011)
City of Wheatland	▪ General Plan Update Master Water Plan (2006) ▪ Johnson Rancho Water Supply Assessment ▪ Hop Farm Annexation Water Supply Assessment
Linda County Water District	▪ Urban Water Management Plan (2011)
Olivehurst Public Utilities District	▪ Urban Water Management Plan (2011) ▪ Bear River Project Water Supply Assessment (2006) ▪ Country Club Estates Water Supply Assessment (2007) ▪ Magnolia Ranch Water Supply Assessment (2013)
Yuba County Water Agency and Member Units: ▪ Cordua Irrigation District ▪ Ramirez Water District ▪ Hallwood Irrigation Company ▪ Browns Valley Irrigation District ▪ Brophy Water District ▪ South Yuba Water District ▪ Dry Creek Mutual Water Co. ▪ Wheatland Water District	▪ Agricultural Water Management Plan (2012) ▪ Groundwater Management Plan (2010) ▪ Yuba IRWMP (2008) ▪ FERC Relicensing Documents for Project No. 2246) (www.ycwa-relicensing.com) (2010-2014) ▪ Lower Yuba Accord (2007) ▪ YCWA Transfer Program ▪ Conjunctive Use Program ▪ Multi-Hazard Mitigation Plan (2007)
Resource Managers	**Documents and Programs**
Central Valley Flood Protection Board	▪ Central Valley Flood Protection Plan (2012)
City of Marysville	▪ City of Marysville General Plan (1985)
City of Wheatland	▪ City of Wheatland General Plan (2006) ▪ External Source Flood Protection Plan (2005)
County of Yuba	▪ Storm Water Management Plan (2004) ▪ Yuba County General Plan (2011) ▪ Yuba County Multi-Jurisdictional Multi-Hazard Mitigation Plan ▪ Low Impact Development (LID) Strategies ▪ Draft Parks Master Plan (2008)
Dobbins Fire Protection District	▪ Multi-Hazard Mitigation Plan (2007)
DWR	▪ Upper Feather River Flood Management Plan (Draft 2013)
DWR, Bureau of Reclamation, YCWA, PG&E, et al.	▪ Lower Yuba Accord (2007)
Regional Water Quality Control Board	▪ Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin Rivers (2009)
State Water Resources Control Board	▪ Watershed Management Initiative for the Sacramento Hydrologic Region (2003) ▪ Development of Flow Criteria for the Sacramento-San Joaquin Delta (2010)
US Forest Service	▪ Tahoe National Forest Land and Resource Management Plan (1990) ▪ Plumas National Forest Land and Resource Management Plan (1990)
Yuba County LAFCO	▪ Municipal Service Review (2008)
NGOs	**Documents and Programs**
Bear-Yuba Land Trust	▪ Strategic Conservation Plan
South Yuba River Citizens League	▪ 21st Century Assessment of the Yuba River Watershed

The Yuba County IRWMP Update incorporates local water resource management planning documents, along with information from groundwater management plans, adjacent IRWMPs, and local general plans, as shown **in Table 10-1**.

Most purveyors of agricultural water in the region, including Marysville Levee Commission, Reclamation Districts 10, 784, 817, 2103, Camp Far West Irrigation, and Plumas Mutual Water Company, do not have adopted planning documents, but as shown in **Table 10-2** below, many of them participated in the IRWM process. A list of all the regional water purveyors and their participation in the IRWMP Update is shown in **Table 10-2**. The information, strategies, and policies in the water management plans have been incorporated in this chapter and elsewhere throughout the Yuba County IRWMP Update. As these plans are updated, the revised versions are reviewed and considered in subsequent IRWM planning efforts. As discussed in Chapter 12 *Goals, Objectives, Issues, and Conflicts*, the goals and objectives of this IRWMP are consistent with local Urban Water Management Plans (UWMPs).

A more comprehensive list of water management and planning documents prepared by other planning agencies and NGOs relevant to the Plan area and used in the preparation of this IRWMP is shown in the IRWMP's document catalog.

Table 10-2. Yuba County IRWM Region Water Purveyors, Planning Documents, and Participation in IRWMP Process					
Agency	**Interest in Groundwater**	**Adopted Water Planning Documents**	**YCWA's Water Advisory Committee Member (part of GMP effort)**	**RWMG Participant**	**Other Involvement in IRWMP**
Yuba County Water Agency & Member Units					
Yuba County Water Agency ▪ Cordua Irrigation District ▪ Ramirez Water District ▪ Hallwood Irrigation Company ▪ Browns Valley Irrigation District ▪ Brophy Water District ▪ South Yuba Water District ▪ Dry Creek Mutual Water Co. ▪ Wheatland Water District	Agricultural Irrigation	▪ Agricultural Water Management Plan (2012) ▪ Groundwater Management Plan (2010) ▪ Yuba IRWMP (2008) ▪ FERC Relicensing Documents for Project No. 2246 (www.ycwa-relicensing.com) (2010-2014) ▪ Lower Yuba Accord (2007)	✓	✓	Lead agency in the IRWMP process; involved in all aspects of IRWMP preparation
Other Irrigators					
Marysville Levee Commission	N/A (levee construction, maintenance, and repair)				
Reclamation District No. 10	Agricultural Irrigation		✓	✓	
Reclamation District No. 784	Agricultural Irrigation		✓	✓	
Reclamation District No. 817	N/A (levee construction, maintenance and repair)			✓	
Reclamation District No. 2103	N/A (levee construction, maintenance, and repair)			✓	

Agency	Interest in Groundwater	Adopted Water Planning Documents	YCWA's Water Advisory Committee Member (part of GMP effort)	RWMG Participant	Other Involvement in IRWMP
Camp Far West Irrigation District	Agricultural Irrigation		✓		
Public Water Suppliers					
California Water Service (for City of Marysville)	Municipal supply	▪ Urban Water Management Plan (2011)	✓		
City of Wheatland	Municipal supply	▪ General Plan Update Master Water Plan ▪ Johnson Rancho Water Supply Assessment ▪ Hop Farm Annexation Water Supply Assessment		✓	▪ Input on IRWMP Land Use chapter ▪ Participation in RWMG
Linda County Water District	Municipal supply	▪ Urban Water Management Plan (2011)	✓	✓	Active participants in IRWMP process; members of RWMG
Olivehurst Public Utilities District	Municipal supply	▪ Urban Water Management Plan (2011) ▪ Bear River Project Water Supply Assessment (2006) ▪ Country Club Estates Water Supply Assessment (2007) ▪ Magnolia Ranch Water Supply Assessment (2013)		✓	Active participants in IRWMP process; members of RWMG
Plumas Mutual Water Company	Agricultural irrigation	None			
Other Agencies Within Basin					
Beale Air Force Base	Municipal supply, groundwater remediation	▪ Air Combat Command: Installation Sustainability Assessment Report (2012)	✓	✓	▪ Reviewed water-related chapters
Yuba County	Well permitting, approval of development plans that may rely on groundwater for supply, general plan	▪ Storm Water Management Plan (2004)	✓	✓	▪ Input on IRWMP Land Use chapter ▪ Participation in RWMG

A brief description and background of some of the relevant water plans reviewed in the preparation of the Yuba County IRWMP Update follows, along with a description of their jurisdiction, how they apply to the IRWMP, and the compatibility of and dynamics between the IRWMP and the water and land use plans.

10.1.1.1 Groundwater Management

In the Yuba County IRWM region groundwater is an important source for many domestic, industrial, and agricultural users, so readers are also directed to these related sections in this chapter: Urban Water Management Plans, Water Supply Assessments, and Agricultural Water Management Plans.

The valley floor of the Plan area is underlain by an alluvial aquifer system that contains significant quantities of groundwater, and in this area all of the municipal water purveyors (Marysville, Olivehurst PUD, Linda CWD, Wheatland, and Beale AFB) rely on groundwater for municipal/industrial water supply. Existing agricultural uses in these areas also rely on groundwater for about 30 percent of their irrigation needs, a number that can be higher during dry years when groundwater is used to substitute for surface water. The foothill and mountain regions of the Plan area are supported by a fractured-rock aquifer which may, at best, yield small quantities of water for residential purposes and are marginal for farming, ranching, or industrial uses.[2] Rural communities in these areas use surface water for 85 to 90 percent of their water needs. Even so, groundwater is an important source for rural homes' individual domestic wells, as well as small public and private water supply systems.

The 2030 Yuba County General Plan Update designates an additional 8 percent of undeveloped land for development in Yuba County, a number that will ultimately result in 24 percent of the Plan area being urbanized.[3] Areas with the highest growth potential are valley agricultural lands in proximity to Olivehurst, Plumas Lake, Linda, Wheatland, and the State Route 65 and 70 corridors. Conversion of these lands to residential and other urbanized uses will have a three-pronged effect on groundwater supply and demand. First, given that residential users typically use less water per acre than agricultural users, conversion from agricultural to residential uses will reduce water demand on both surface and subsurface supplies. The Draft Water Supply Assessment for the Magnolia Ranch project, which proposes 3,000 to 4,200 dwelling units and other mixed uses on 1,039 acres of land currently used for growing rice, found that project implementation would result in water demand at the site decreasing from approximately 6,400 acre-feet per year (af/yr) to support agricultural uses to 1,104 af/yr to supply proposed urban uses.[4] Second, however, the Magnolia Ranch Water Supply Assessment also found while the Yuba basin "is expected to see an overall reduction in the use of groundwater, the concentration of urban groundwater wells may result in local drawdown cones, and possibly water quality problems in some areas where freshwater overlies poorer-quality groundwater, such as the Wheatland area and potentially the deeper aquifer in the Olivehurst/Linda area."

The third potential effect of conversion of agricultural lands to urban uses is the loss of groundwater recharge from percolation of applied surface irrigation water. Runoff and recharge from irrigation is thought to be a significant contributor to groundwater recharge, offering over 30 percent of the overall recharge to the valley's groundwater basins. In tandem with the increased use of groundwater for municipal and industrial purposes, the reduction of surface water used in irrigation may therefore result in a cumulative reduction in groundwater recharge.

However, the Yuba County General Plan EIR assessed the impacts of General Plan buildout on groundwater recharge and supply and found them to be less than significant within the existing regulatory and planning

[2] Yuba County, General Plan Background Update Report on Hydrology and Water Quality (February 2009).
[3] Yuba County, 2030 General Plan Update (Adopted June 7, 2011).
[4] Olivehurst PUD, Magnolia Ranch Water Supply Assessment (July 2013).

environment. Among the mitigating plans and policies that reduce groundwater impacts are UWMPs, which address drought contingency planning, water demand management, reclamation, and groundwater resources; YCWA's Groundwater Management Plan, which is designed to implement conjunctive use strategies, perennial yield strategies (the sustainable rate at which groundwater can be withdrawn from the basin without lowering water levels), and avoidance of overdraft; and the 2030 General Plan itself. The 2030 General Plan includes open space designations for important recharge areas for the underlying groundwater basins, including areas near the Feather, Yuba, and Bear Rivers and Honcut Creek. The General Plan also includes policies that promote groundwater infiltration and prevent overdraft.

Development of water resources for agricultural lands within the incorporated areas of Yuba County, Marysville, and Wheatland, is not a significant issue as these are highly urbanized areas. The Marysville General Plan does not address the source or supply of water for new development; however, growth is constrained by the ring levee system around the city to such an extent that there is very little vacant land remaining in Marysville. According to City of Wheatland planning staff, during the planning process for new development projects, it is assumed that groundwater resources will be available for utilization.

In the foothill and mountain regions of the Plan area, where the anticipated growth is much less than the valley floor, no large-scale projects are currently proposed. New development is primarily in the form of small subdivisions or buildout of individual vacant lots larger than five acres, served by individual wells.[5] As mentioned earlier, groundwater is an inadequate and unreliable water supply for large-scale use in the foothills. While most growth is anticipated on the valley floor, the foothill and mountain domestic users who rely on groundwater may experience water supply issues, especially in the face of climate change and continued drought conditions.

YCWA Groundwater Management Plan Update 2010

YCWA collaborates and coordinates with many different agencies on groundwater management and planning activities. Each of the agencies with which YCWA collaborates are involved in groundwater pumping, monitoring, and data management, so information sharing and collaboration on groundwater activities is mutually beneficial to protect and preserve the resource. During preparation of its Groundwater Management Plan (GMP), YCWA facilitated a Water Advisory Committee comprised of various outside agencies. **Table 10-2** includes information on participants in that process.

YCWA first prepared a GMP in 2005 and last updated it on December 14, 2010. Water Code Sections 10750 et seq. and the Yuba County Water Agency Act (Assembly Bill 3030) authorize YCWA to adopt, implement, and update a GMP. YCWA has committed to a five-year evaluation interval of its GMP in order to promote its goals and objectives. The overriding goal of the GMP is to "maintain a viable groundwater resource for the beneficial use of the people of Yuba County." To meet this goal, YCWA adopted seven specific basin management objectives (BMOs). **Table 10-3** compares the GMP's BMOs with corresponding objectives identified by the RWMG.

[5] Boeck, Van., pers. comm. via email with Jessica Hankins (April 12, 2014).

Table 10-3. Comparison of Groundwater Management Plan Basin Management Objectives and IRWMP Groundwater Objectives		
GMP BMO (summarized)	**IRWMP Objective (summarized)**	**Comments**
1: Maintain sustainable groundwater elevations	1.2: Promote water conservation and water use efficiency by instituting techniques such as groundwater recharge, conjunctive management, irrigation efficiencies, municipal water conservation, water recycling and reuse	N/A
2: Protect against and monitor for potential inelastic land surface subsidence	N/A	N/A
3: Maintain and improve groundwater quality impacts from toxins of industrial uses and TDS of deep groundwater pumping	2.2: Minimize water quality impacts from flood, effluent discharge and wastewater spills	No direct reference in RWMG objective to impacts from industrial uses and deep groundwater pumping
4: Evaluate the relationship (if any) between groundwater pumping and surface water flows, to mitigate any impacts to fish and wildlife habitats	2.5: Maintain and improve water quality required to restore and protect freshwater ecosystems, fisheries, and groundwater-dependent habitat	N/A
5: Improve communication and coordination among Yuba groundwater basin stakeholders	1.4: Promote disaster preparedness and conservation planning efforts 1.8: Promote regional education and outreach regarding water supply issues and needs	N/A
6: Maintain local control of the Yuba groundwater basin	N/A	N/A
7: Improve understanding of the Yuba groundwater basin and its stressors by continuing with data programs and exploratory studies and investing in new research to improve understanding of groundwater usage, geology, and flow	3.4: Enhance floodplain function and wildlife habitat while achieving multiple flood management benefits	N/A

From: YCWA, Groundwater Management Plan (2010), and Draft Chapter 13 Goals, Objectives, Issues and Conflicts, Draft Yuba IRWMP Update (2014).

As seen in **Table 10-3**, no inconsistencies were identified during the comparison, and in most cases the plans are compatible. The GMP BMOs do not always have corollary IRWMP objectives, but this reflects the different focuses of the two plans. A similar comparison of the IRWMP with land use planning documents revealed that the same held true for plan objectives, and that there were no inconsistencies among documents.

YCWA Transfer Program

Currently, YCWA monitors North and South Yuba groundwater subbasin levels in cooperation with DWR, gauges groundwater quality, conducts groundwater studies, and exercises groundwater resources for the benefit of the county and state. Groundwater supplies in the Yuba County IRWM region lack resiliency after droughts based on past events, but they are remaining more stable with interbasin water transfers[6] and the introduction of surface water supplies to agriculture.[7] Ultimately, this could result in increased vulnerability to

[6] Yuba County Water Agency, Yuba County Water Agency Groundwater Management Plan (2010).
[7] Ibid.

climate change if the Yuba basin is overdrawn due to out-of-basin transfers or diversions, climate drying, or shifting state policies that could tax this finite supply. One of the Yuba County IRWM region's water management strategies has been to move water from one river basin to another to provide water for all beneficial uses. The Yuba County Water Agency Transfer Program deals in both surface and groundwater substitution transfers, and for groundwater substitution transfers, YCWA participates in close monitoring of the groundwater basin. Many (if not most) of these projects seek to capture flows during the winter season and use them to meet demand from municipal/industrial users, agricultural users, and the environment for water during the summer.[8] Groundwater substitution transfers have been completed in six relatively dry years since 1991; during such a year, groundwater demand can double and is then generally recharged within two to three years after pumping ends.

As described in Chapters 6 and 7, *Region Description* and *Water Supply,* respectively, conflicts surrounding fisheries and the interrelated conflicts of regulatory compliance and out-of-region water transfers have long been a source of discord in the region. The RWMG also differed over whether new storage facilities should be considered for out-of-region water transfers. However, on the subject of transfers from existing groundwater sources, the RWMG and local General Plans are silent.

YCWA Conjunctive Use Program (Part of the Lower Yuba Accord)

The 2007 Lower Yuba River Accord between the YCWA and seven of the local irrigation districts/mutual water companies includes three major agreements and one with PG&E. The three agreements include a Fisheries Agreement, Water Purchase Agreement, and several Conjunctive Use Agreements, all of which work in tandem to protect water resources for agricultural, municipal, and environmental beneficial uses. To provide the required flows for the Fisheries Agreement, YCWA implements the Conjunctive Use Agreements which integrate surface water and groundwater supplies of the participating irrigation districts/mutual water companies with the operations of the Yuba River Development Project at the New Bullards Bar Reservoir. These agreements ensure that all groundwater use will be within the safe yield of the groundwater aquifer, and the program is consistent with YCWA's GMP. YCWA and local irrigation districts/mutual water companies operate a Groundwater Monitoring and Reporting Program to ensure that groundwater pumping associated with the Conjunctive Use Program will be within the safe yield of the groundwater aquifer to safeguard agricultural, domestic, and municipal wells. Under the Yuba Accord, groundwater is used only to irrigate farmland, and no groundwater is exported out of Yuba County.

As part of the conjunctive use program, YCWA developed a groundwater adaptive management tool (GAMT) in 2008 to quantitatively integrate groundwater basin conditions into YCWA's planning process. The GAMT uses the historical groundwater level data in the Yuba River basin in coordination with the Yuba River Basin Model, the existing surface water planning tool, to address groundwater substitution transfer requests from DWR and other potential water purchasers. The GAMT can be used as a predictive tool of basin response and recovery to plan for future groundwater transfers and to help create a report documenting the status of the groundwater basin, pre- and post-transfers.

The local municipal general plan goals and policies, as well as the RWMG's identified objectives support conjunctive use. Yuba County General Plan Policy CD 14.12, for example, states that "The County will coordinate with Yuba County Water Agency on conjunctive water use."

More details on the Accord and its wider benefits are discussed below in the Watershed Management and Restoration section of this chapter.

[8] Department of Water Resources, California Water Plan (2009).

10.1.1.2 Urban Water Management

Urban Water Management Plans serve as master plans for water supply and resources management, and must be prepared by urban water suppliers that provide over 3,000 af of water annually or serve more than 3,000 connections. These plans function as long-term planning documents, and the conclusions and recommendations from the UWMPs determine key aspects of long-term capital investment by each agency, as well as guidance for Plan project development.

UWMPs describe the reliability of the water supply and vulnerability to seasonal or climatic shortage, both of which inform the IRWMP, as follows:

- For any water source that may not be available at a consistent level of use, given specific legal, environmental, water quality, or climatic factors, the UWMP describes plans to replace that source with alternative sources or water demand management measures, for an average water year, a single dry water year, multiple dry water years. This is an adaptive strategy that will help the region remain climate resilient.
- The UWMP describes opportunities for exchanges or transfers of water on a short-term or long-term basis and actions to be undertaken to prepare for and implement during a catastrophic interruption of water supplies, including a regional power outage, an earthquake, or other disaster.

Preparation of UWMPs is coordinated with local water, wastewater, groundwater, and planning agencies and includes a description of the wastewater collection and treatment systems in the service area. Coordination such as this is essential to successfully implementing an IRWMP. One key requirement for UWMPs is that they must be consistent with the local jurisdiction's policies on water management and natural resources. UWMPs are among the crucial documents used in the preparation of IRWMPs as well.

The UWMPs in the Plan area include those prepared by the following entities in 2011:

- California Water Service (for the City of Marysville)
- Linda County Water District
- Olivehurst Public Utilities District

These entities, along with the City of Wheatland, also monitor their groundwater levels on a monthly basis. While the City of Wheatland is not required to prepare a UWMP, it has prepared a Master Water Plan, the purpose of which was to estimate water demands needed to serve the General Plan Update's proposed land uses and identify the available water sources to serve the GPU demands.

Beale Air Force Base (AFB) is also not required to prepare a UWMP with only 382 households at the time of the 2010 Census.[9] However, Beale has prepared an Installation Sustainability Assessment Report (ISAR) (2012) that is intended to facilitate resource sustainability and, in turn, sustainability of the Base itself. Water use in 2009 was 500 million gallons, a number that the ISAR identifies as an 'off-target metric' that equates to high water consumption by industry standards and requires further efforts at water conservation and sustainability of supply. Domestic users residing at Beale AFB reportedly use approximately 300 gallons per day compared to, for example, domestic water consumers in Olivehurst PUD who used an average of 146 gallons per day from 2006 to 2011.[10] Additionally, potable water at Beale is used not only for residential consumers, but also for industrial, commercial, and irrigation purposes, including for its golf course. The report also indicates that

[9] US Census Bureau, 2010 Census, American FactFinder.
[10] Olivehurst PUD, 2010 Urban Water Management Plan (Adopted November 17, 2011).

"Beale AFB currently does not implement storm water quality and quantity practices on new development and does not return storm water flows to pre-development levels on individual sites." The ISAR recommends implementation actions to improve the water sustainability scenario at Beale AFB. A sampling of the recommended actions are listed below.

- Continue to implement the required two percent reduction per year of water consumption based on Executive Order 13423.
- Replace existing landscaping with native plantings and xeriscape.
- Capture storm water for irrigation purposes.
- Incorporate pervious concrete pavements in parking areas and sidewalks.
- Implement storm water requirements under Section 438 of the Energy Independence and Security Act.

These recommended actions are compatible with IRWMP objectives and local water and land use plans.

10.1.1.3 Water Supply Assessments

Coordination between land use planners and water managers may or may not occur during the initial review and evaluation of a project, depending on the scope of the project. However, projects over 500 units typically result in more land use planner/water purveyor collaboration due to the requirements of Senate Bills (SB) 221 and 610. These statutes ensure the consideration of water supply in land use decisions related to large residential developments. SB 221 requires projects with more than 500 proposed dwelling units to obtain verification from the water purveyor that it has a sufficient supply to service the proposed project, as well as all other existing and anticipated future uses, including agricultural and industrial, in its service area for a 20-year period in normal, single dry, and multiple dry years. SB 610 requires certain development projects, including those with more than 500 proposed dwelling units, and projects that will increase residential service connections by more than 10 percent, to prepare a water supply assessment (WSA). The WSA is used by the lead planning agency in its state-mandated environmental review of the project under the California Environmental Quality Act (CEQA). The WSA must evaluate the water purveyor's supplies to meet existing and anticipated demands along with the proposed project.

The WSA may work hand in hand with the local UWMP, if the UWMP anticipated the development. Both of these statutes repeatedly identify the UWMP as a planning document that, if properly prepared, can be used by a water supplier to fulfill the specific requirements of these statutes' standards.[11]

One of the limitations of SB 221 and SB 610 is that the opportunity for land use and water supply planning collaboration they generate is only applicable to large-scale residential developments. Even several residential developments of 499 units in size would not statutorily trigger the nexus of water supply/land use planning that one development over 500 units would. Yet another limitation of SB 221 and SB 610 is that they require only a 20-year analysis of water supply, a relatively short timeline for planning water supplies into the future. As previously mentioned, however, cumulative impacts of planned buildout projected in the Yuba County General Plan have been evaluated in the General Plan EIR, which found the impacts less than significant due to existing regulatory requirements and water plans in combination with the new General Plan policies.

[11] CA Department of Water Resources, Guidebook for Implementation of Senate Bill 610 and Senate Bill 221 of 2001 to assist water suppliers, cities and counties in integrating water and land use planning. (October 8, 2003). Available at: http://www.water.ca.gov/pubs/use/sb_610_sb_221_guidebook/guidebook.pdf>.

WSAs at times acquire information from IRWMPs; conversely, the Yuba County IRWMP Update uses information from the following Plan area WSAs:

- Draft Magnolia Ranch WSA (2013)
- Country Club Estates WSA (2007)
- Bear River Project WSA (2006)
- Johnson Rancho WSA (2008)
- Hop Farm WSA (2008)

As an example, the Country Club Estates WSA prepared by Olivehurst PUD stated that the YCWA's Groundwater Master Plan as well as the draft 2008 Yuba IRWMP were instrumental in preparing the technical analysis of water supply availability for the planned development. The draft WSA prepared by Olivehurst PUD in 2013 for the proposed Magnolia Ranch project relied heavily on information found in the Olivehurst 2010 UWMP, and it used information from the adopted 2008 IRWMP as well.

10.1.1.4 Agricultural Water Management

Approximately 85 to 90 percent of irrigation water in Yuba County is supplied by surface water. Exceptions include Reclamation District 10 in the North Yuba subbasin and parts of Reclamation District 784 in the South Yuba subbasin, where groundwater is the primary source of irrigation water. All YCWA member units in both subbasins use groundwater to supplement surface water supply for agricultural use.[12] YCWA's 2010 GMP reports that groundwater pumping by Ramirez Water District, CID, HID, and BVID slowed when surface water deliveries began to these districts. The shift in agricultural water usage starting in the 1970s from groundwater to surface water has allowed groundwater levels to recover from overdraft conditions.

YCWA Agricultural Water Management Plan

The Agricultural Water Management Planning Act (Act) [Section 10826 (a)] requires every agricultural water supplier providing water to more than 10,000 irrigated acres, excluding recycled water, to adopt and submit an Agricultural Water Management Plan (AWMP) every five years to DWR. Plans are intended to assure the appropriate level of reliability to sufficiently meet the needs of its agricultural customers during normal, dry, and multiple dry years. As such, they indicate water use over time for a major economic sector, again informing the IRWM process toward balancing water needs and in potential project development.

YCWA prepared its 2010 AWMP in accordance with the requirements of the Water Conservation Act of 2009 (SBx7-7). A key aspect of YCWA's water management activities is the conjunctive management of available surface water and groundwater supplies. To that end, YCWA has endeavored to make available surface water from the Yuba River for irrigation by its member units, reversing potentially serious overdraft in the South Yuba groundwater subbasin. Additionally, YCWA has actively facilitated the conjunctive use of groundwater by the member units to reduce demand for surface water in times of limited supply and to increase statewide water supplies by making surface water available for transfer to meet environmental or other demands through groundwater substitution. Extensive recovery and reuse of spillage and tailwater is practiced within the member unit service areas, as well, to contribute to recharge of the underlying aquifer. The net effect of this conservation is to decrease Yuba River diversions and groundwater pumping, enhancing local supply and increasing the amount of water available for transfer.

SBx7-7 describes 16 Efficient Water Management Practices (EWMPs) aimed at promoting efficient water management. Of these, 2 are mandatory, and the remaining 14 are to be implemented if technically feasible

[12] YCWA, Agricultural Water Management Plan, 2010.

and locally cost effective. Of the 14 conditional EWMPs, YCWA is implementing all of those that are technically feasible at locally cost-effective levels and is seeking to increase implementation activities for key EWMPs that most effectively support YCWA's water management objectives through the pursuit of additional funding.

Although the AWMP necessarily focuses on agricultural water management, it also takes into consideration the overall water management practices of YCWA, including those practices encompassing groundwater and surface water management. As such, YCWA's GMP, the Lower Yuba Accord, and the Yuba IRWMP were key coordinating documents in the preparation of the AWMP. Because they are updated every five years, there will also be forthcoming opportunities for further collaboration between the RWMG and the agencies preparing the AWMP, resulting in dynamic and flexible AWMP and IRWMP documents.

10.1.1.5 Flood Protection and Other Hazard Mitigation

According to the Yuba County Multi-Jurisdictional Multi-Hazard Mitigation Plan, flooding is the "greatest natural disaster" that occurs in Yuba County and will continue to recur without intervention. Flooding is primarily an issue for the valley regions of the Plan area, though dam failures (the risk of which is considered by the Division of Dam Safety to be "very low probability") could result in flood risks to foothill and mountain area residents as well.

Levee construction was a common solution to the problem of flooding, but these structures have failed on numerous occasions for a variety of reasons ranging from insufficient design and materials to extraordinary flood events. The 2013 Feather River Regional Flood Management Plan states the existing levee system is "inadequate to protect developing areas."[13] Lake Oroville and New Bullards Bar Reservoir, as well as an extensive system of levees, provide flood control along the Feather, Yuba, and Bear Rivers, Dry Creek, and Huncut Creek. Within Yuba County, levee maintenance is the responsibility of the reclamation districts, including Reclamation District No. 10, RD No. 784, RD No. 817, and RD. No. 2103. Relevant findings of regional flood planning have been incorporated into several Plan chapters.

Feather River Regional Flood Management Plan and Central Valley Flood Protection Plan

To better address the regionwide flood management issues and concerns, a number of stakeholders in the Feather River Basin recently partnered with DWR to develop the Feather River Regional Flood Management Plan (FRRFMP). The FRRFMP addresses flood management for 302,000 acres of levee-protected lands within Sutter, Butte, and Yuba Counties and a small portion of Placer County along the Bear River near Wheatland.

The partnering Yuba RWMG stakeholders include YCWA, Three Rivers Levee Improvement Authority (TRLIA), and the Marysville Levee Commission (MLC); agencies outside the Yuba IRWMP region include the Sutter Butte Flood Control Agency (SBFCA). The FRRFMP incorporates the concerns and priorities of various communities in the Feather River Basin, including local Levee Maintaining Agency representatives, elected officials, property owners, businesses, interested individuals, small community representatives, native Tribes, and NGOs.

The FRRFMP establishes the flood management priorities of the Feather River Basin and is intended to facilitate future funding and implementation of much-needed flood risk reduction projects throughout the Feather River Basin. This regional approach allows for improved coordination with state and federal agencies in the planning and implementation of flood management strategies, which increases the local benefit of program implementation while reducing local cost share.

[13] California Department of Water Resources, Feather River Region: Administrative Draft Regional Flood Management Plan (Rev. October 4, 2013).

The FRRFMP is currently in progress and the latest Administrative Draft version was posted to the document website in October 2013. The plan is designed in accordance with the recently adopted 2012 Central Valley Flood Protection Plan (CVFPP) which provides a broad vision to manage flood risks in the Central Valley and to guide regional- and state-level financing plans for investments which are anticipated in the range of $14 billion to $17 billion over the next 20 to 25 years. The CVFPP proposes a system-wide investment approach for sustainable, integrated flood management in areas currently protected by facilities of the State Plan of Flood Control. The CVFPP will be updated every five years, with each update providing support for subsequent policy, program, and project implementation. The FRRFMP is designed to inform the 2017 Five Year Update of the CVFPP with more detailed information about the needs of the Feather River Basin.

The objectives of the regional planning process are founded on, and consistent with, the goals of the 2012 CVFPP as described below:

Goals of the FRRFMP

Primary

Improve Flood Risk Management – Reduce the chance of flooding, and damages once flooding occurs, and improve public safety, preparedness, and emergency response through:

- identifying, recommending, and implementing structural and nonstructural projects and actions that benefit lands currently receiving protection from facilities of the SPFC; and
- formulating standards, criteria, and guidelines to facilitate implementation of structural and nonstructural actions for protecting urban areas and other lands of the Sacramento and San Joaquin River basins and the Delta.

Supporting

- Improve operations and maintenance;
- promote ecosystem functions;
- improve institutional support; and
- promote multi-benefit projects.

While the regional goals are consistent with the CVFPP's, the regional objectives place a greater emphasis on the preservation of economically productive agricultural land than does the CVFPP. The RFMP states that because "agriculture provides the foundation for the regional economy, loss of highly productive agricultural lands to accommodate larger flood conveyances, transient floodplain storage, and wildlife habitat could affect the long-term viability of the regional economy, including the many secondary and tertiary businesses which support agriculture." The RFMP further asserts that the "region seeks to take maximum advantage of these evolving opportunities while minimizing future land use conversion to wildlife and fisheries habitat" due to the number of existing habitat restoration and augmentation projects, such as the TRLIA setback levees along the Feather and Bear Rivers. This emphasis on maintaining productive agricultural lands is mirrored in IRWMP Objective 3.7: "Steward the region's biodiversity and ecological resources that directly provide opportunities for public access, recreation, education while maintaining the co-equal objectives of flood protection and preservation of agricultural lands." Yuba County General Plan Policy NR 3.15 also supports the protection of local agricultural operations, though where agricultural and restoration uses conflict, the General Plan is silent.

200-Year Flood Protection Standards

New California flood protection standards under the CVFPP require 200-year flood protection for structures (while FEMA still requires 100-year flood protection). These new flood protection mandates require not only

physical protection from 200-year flood events, typically in the form of levee improvements, but also trigger increased insurance requirements. The RFMP indicates two alternative solutions to this issue: the flood management system must be improved, or further development in areas prone to flooding must be limited. Recreation districts within the Plan area favor levee construction over development limitations, and Wheatland General Plan Policy 9.C.3 allows project development in floodplains with levee construction as mitigation. Yuba County also supports collaboration with the various flood control agencies to improve and maintain the levee system that "protects developed and planned development areas." New growth in the Plan area will place additional pressures on the use of floodplains for urban development.

The recently adopted Yuba County General Plan Update (2011) contains several goals and policies that support flood control and minimization of disturbance to floodplains. Flood control objectives are to be incorporated into recreational open space areas along rivers and streams under Policy NR1.11, and the open space designations of "Critical Habitat" and "Water and Groundwater Recharge Areas," primarily found along the county's major waterways, support the protection of water quality and habitat associated with riverine and riparian areas.

According to Yuba County planning staff, development cannot occur in floodplain areas unless structures are elevated above the 100-year base flood elevation and an Elevation Certificate is provided. TRLIA has improved the levees along the Feather River south of Marysville from the Yuba River to the Bear River; along the north side of the Bear River from the Feather River to the Western Pacific Interceptor Canal; and along the Western Pacific Interceptor Canal from the Bear River to south of McGowan Parkway in the southern area of the county. TRLIA has also improved levees on the the south side of the Yuba River from the Feather River to just west of the Yuba Gold Fields. TRLIA is working on improving the levees in the Yuba Gold Fields, but there is no current estimated completion date for the Gold Fields area. The levees north of Marysville have not been assessed, and FEMA therefore deems them inadequate to provide 100-year protection to the area north of Marysville to the county line, east of the Feather River, and west of the Union Pacific Railroad.[14]

Yuba County requires that new structures be constructed five feet above the adjacent grade in order for the property owner to obtain reduced flood insurance rates. There is only one area in the southern part of the county (where flooding occurs more frequently) with a currently proposed large development project, Magnolia Ranch. Within this development is an area in the 100-year flood zone proposed for open space as part of the project's drainage system.

The General Plan policies of the Cities of Marysville and Wheatland General Plan support similar protection of inhabited uses from the deleterious impacts of floods, while permitting compatible uses such as open space and recreation within floodplains. IRWMP Objective 5.1 supports the improvement of flood protection in the region and regional collaboration on emergency preparedness, with performance metrics including collaboratively developed plans and reduction of flood insurance rates and risk.

Multi-Jurisdictional Multi-Hazard Mitigation Plans

Hazard mitigation plans identify and develop strategies to address the risks from natural hazards such as wildfires, flooding, severe weather, dam failure, drought, and climate change. They also establish a basis for coordination among participating agencies and assist in meeting the requirements of federal assistance program.

[14] Boeck, Van, email communication with Jessica Hankins (April 18, 2014).

Per the Disaster Mitigation Act of 2000, Yuba County and other local government agencies and special districts are required to develop and adopt Multi-Hazard Mitigation Plans to be eligible for federal disaster assistance and hazard mitigation grant funds. In the Plan area, Yuba County, YCWA, and Dobbins Fire Protection District have all adopted Multi-Hazard Mitigation Plans. The goals and strategies of these plans are consistent across the documents, with the main purpose being to create a framework for the procedures and projects that will reduce risk and losses in an emergency situation such as wildfire, flooding, or earthquake. The process of stakeholder and community participation is an integral component in the hazard planning process.

As a result of disaster losses and damage caused by two major levee failures and two wildland fires in the last two decades, the Yuba County Board of Supervisors implemented post-disaster mitigation efforts as well as pre-disaster mitigation projects such as fire fuels treatment projects, flood protection projects, and elevation of homes for increased flood protection. The mission statement of the Yuba County Multi-Jurisdictional Multi-Hazard Mitigation Plan is "[t]o prevent losses by identifying and implementing hazard mitigation strategies and projects to reduce and eliminate long-term risk to people, property and the environment." Local plans and the RWMG also support the general objectives of the hazard plans.

City of Wheatland External Source Flood Protection Plan

The City of Wheatland's 2005 External Source Flood Protection Plan (ESFPP) was developed as part of its General Plan update process. The Wheatland ESFPP evaluates three alternative flood protection actions to protect existing and proposed development areas (up to nearly 4,000 acres) in the City of Wheatland, all of which consist of construction of new levees or improvements to existing levees. While levee construction and improvement are not in opposition to the goals, objectives, and resource management strategies of the Yuba County IRWMP Update, the RWMG has developed a diverse set of flood management strategies that extends beyond the construction and improvement of levee systems.

Storm Water Management

The US Environmental Protection Agency (USEPA) has established a two-tiered program to address municipal storm water discharges, administered by the applicable regional water quality control board. These plans address and affect the IRWMP primarily about water quality and storm water management, and related projects.

Yuba County, in conjunction with the City of Marysville, prepared and adopted a Storm Water Management Plan (SWMP) in 2004 to fulfill requirements of the National Pollutant Discharge Elimination System (NPDES) Phase II requirements for Small Municipal Separate Storm Sewer Systems. The Yuba County SWMP provides a plan for the affected agencies within the county to follow Best Management Practices (BMPs), measurable goals, and timetables for the implementation of six minimum-control measures required by the USEPA and the State Water Resources Control Board (SWRCB). The measures include public education, public participation, illicit discharge detection and elimination, construction site storm water runoff control, post-construction storm water management, and pollution prevention/good housekeeping for municipal operations. A report is prepared annually to identify the progress of the SWMP implementation. The SWMP is a highly dynamic document, due in large part to the rapidly evolving nature of storm water regulations. Because of the SWMP's flexibility in providing ongoing revisions as necessary to the document (without waiting for a seminal fifth or twentieth year as is the case with many other planning documents), this document and its preparing agencies, Yuba County and Marysville, are good candidates for a strengthened collaborative relationship with the RWMG and IRWM process.

10.1.1.6 Watershed Management and Restoration

The premise of watershed management is that water quality and ecosystem problems are best addressed at the local watershed level rather than at the individual discharger-, waterbody-, or state-agency-level. The watershed approach has opened the door to a more holistic method of solving environmental and resource management problems by using the experience of locally based watershed partnerships. In turn, the state recognizes that it has an ongoing responsibility to help local stakeholders assess their watersheds, create watershed plans, and implement watershed management measures to address broad concerns, such as those involving water quality, riparian and wildlife habitat, water supply, flooding and fires—the many issues that often cross political and regulatory boundaries and therefore require significant coordination in order to find solutions.

Watershed management and restoration plans are based on watershed planning units and vary in their scope, location, and authority. They are used in the Yuba County IRWMP to identify issues and vulnerabilities, and often suggest adaptive strategies to make the watershed more resilient. Thus, they help inform objectives and projects.

Goal NR1 and its corresponding policies in the Yuba County General Plan speak to the need for "High quality, accessible public recreational open space." Of the policies attending this goal, Policy NR1.5, NR1.11, and NR1.16 promote the recreational use of open space corridors along rivers and streams along with habitat preservation and restoration uses. Biological Resources Goal NR5 includes many policies supporting the protection, enhancement, and restoration of habitat along the Yuba River. The Marysville and Wheatland General Plans also identify similar goals and objectives in their Open Space, Conservation, and Recreation Element and Environmental Resources Element, respectively. The RWMG identified several objectives consistent with the county and city policies that promote recreation planning that also manages human impacts on watershed health, and other objectives that support the enhancement and restoration of habitat where feasible. The county and city policies appear to be consistent with the IRWM issues.

Basin Plan for the Sacramento River Basin[15]

The Clean Water Act requires that the EPA adopt water quality standards for surface waters within the United States, and that these standards be reviewed and revised, if necessary, at least every three years. The SWRCB carries out its water quality protection authority through the application of specific Regional Water Quality Control Plans, formulated and adopted by the Regional Water Quality Control Boards (RWQCBs), which submit these plans to the SWRCB for review and approval.

RWQCB basin plans provide standards through: 1) a designation of existing and potential beneficial uses, 2) water quality objectives to protect those beneficial uses, and 3) programs of implementation needed to achieve those objectives. The RWQCBs are required to consider a number of items when establishing water quality standards, including: 1) past, present, and probable future beneficial uses; 2) environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto; 3) water quality conditions that could reasonably be achieved through the coordinated control of all factors that affect water quality in the area; and 4) economic considerations.

SWRCB's management goals are specified in Central Valley RWQCB's Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin Rivers, the fourth edition of which was initially adopted in 1998 and which was most recently revised in 2009 (Central Valley RWQCB 1998). The Basin Plan formally sets forth designated

[15] Excerpted from Yuba County Water Agency Pre-application Document, 2009.

existing and potential beneficial uses and water quality objectives for areas, including the Yuba River and the entire Yuba County IRWM region.

The Basin Plan divides the Yuba River into two Hydro Units (HU): 1) HU 517, which includes the Yuba River and its tributaries upstream of the US Army Corps of Engineers' (USACE) Englebright Reservoir; and 2) HU 515.3, which includes the Yuba River from USACE's Englebright Dam to the Feather River. The Basin Plan identifies numerous beneficial uses, some of which include municipal and domestic supply, agricultural supply, industrial supply, groundwater recharge, recreation, fishing, and habitat.

Water quality objectives included in the plan establish criteria for meeting the plan's goals for several water-quality parameters. Parameters identified in the plan for inland surface waters include levels of bacteria, biostimulatory substances, chemical constituents, dissolved oxygen, oil and grease, pH, pesticides, salinity, sediment, temperature, toxicity, and turbidity. Groundwater parameters include bacteria, chemical constituents, radioactivity, tastes and odors, and toxicity.

The relevant local planning documents, in addition to those objectives identified in the IRWM process, all support these water-quality objectives. No inconsistencies have been identified among these documents.

Watershed Management Initiative for the Sacramento Hydrologic Region (2003)

The Watershed Management Initiative (WMI) was approved as part of the 1995 SWRCB Strategic Plan and remains a part of the current Strategic Plan. The WMI establishes a broad framework overlying the numerous federal- and state-mandated priorities. As such, the WMI helps the RWQCBs achieve water resource protection, enhancement, and restoration while balancing economic and environmental impacts.

The integrated approach of the WMI involves three main ideas:

1. Use water quality to identify and prioritize water-resource problems within individual watersheds. Involve stakeholders to develop solutions.
2. Better coordinate point source and nonpoint source regulatory efforts. Establish working relationships between staff from different programs.
3. Better coordinate local, state, and federal activities and programs, especially those relating to regulations and funding, to assist local watershed groups.

The Yuba, Bear, and Feather watersheds are part of the Sacramento Hydrologic Region WMI. The Yuba County IRWM region's water-quality issues are compatible with the issues addressed in the Central Valley RWQCB's Watershed Management Initiative chapter for the Central Valley.[16] These common issues include metals, sedimentation, and temperature.

FERC Licensing Requirements

While FERC licenses for management of hydroelectric projects have influence on planning documents mentioned in this Plan, they are not planning documents in and of themselves, and are therefore not covered in this chapter. For further discussion of FERC licensing, see Chapter 6 *Region Description,* Chapter 7 *Water Supply*, and Chapter 13 *Resource Management Strategies*.

[16] Regional Water Quality Control Board, Central Valley Region, Watershed Management Initiative Chapter (December 1, 2002, with rev. October 2004).

Development of Flow Criteria for the Sacramento-San Joaquin Delta

The SWRCB is establishing flow requirements for water coming from rivers that flow into the Delta to meet the Delta's restoration and water-supply goals. Many of these river systems' headwaters are located in the foothills region of the Plan area. If more water is required for flow into the Delta, it will largely originate from the upstream areas of origin, which have separate needs related to local community sustainability and services already being provided for downstream interests.[17] In 2010, SWRCB finalized the Development of Flow Criteria for the Sacramento-San Joaquin Delta (Flow Criteria), the purpose of which was to identify new flow criteria necessary for fish protection in the Sacramento-San Joaquin Delta (Delta) ecosystem in accordance with the Delta Reform Act of 2009, Water Code Section 85000 et seq. The Flow Criteria do not have any regulatory or adjudicative effect but are used to inform planning decisions for the Delta Plan being prepared by the Delta Stewardship Council and through the collaborative Bay Delta Conservation Plan effort. The SWRCB recognizes that there are many other important beneficial uses that these waters support such as municipal and agricultural water supply and recreational uses. The SWRCB indicates in Flow Criteria that it must consider and balance all competing uses of water in its decision-making. More broadly, the SWRCB has stated that it will factor in relevant water quality, water rights, and habitat needs as it considers potential changes to its Bay-Delta objectives.[18] Therefore, these flow criteria have the potential to influence regional water planning documents, including the IRWMP, into the future.

Recovery Plan for Chinook Salmon and Steelhead

The National Marine Fisheries Service developed a Recovery Plan for the Sacramento River winter-run Chinook salmon, the Central Valley spring-run Chinook salmon, and the California Central Valley steelhead (June 2014) that includes the Plan area. The goal of the Recovery Plan is to restore and safeguard these special-status species to the point where Endangered Species Act (ESA) protections are no longer warranted. The foothills region of the Plan area is listed as a primary reintroduction area in the plan. Spring-run Chinook salmon and Central Valley steelhead spawn and/or migrate in the Plan area. The Plan area also contains Critical Habitat designations on the Yuba River for Central Valley spring-run Chinook Salmon and steelhead.

The Recovery Plan lists numerous actions to recover the populations of spring-run salmon and steelhead. RWMG members evaluated the Recovery Plan and concluded that the Plan does not create any substantive conflicts with the Yuba County IRWMP and that the recovery actions identified for the Yuba River are largely consistent with the goals, objectives, and strategies noted in the Yuba IRWMP update.

Bear Yuba Land Trust Strategic Conservation Plan

The Bear Yuba Land Trust (BYLT) is a non-profit NGO working in the Bear and Yuba watersheds to protect and conserve lands for public access, recreation, cultural resources preservation, and habitat conservation purposes by acquiring land, conservation easements, and through restoration projects and management agreements. BYLT's newly prepared Strategic Conservation Plan (SCP) guides decision-making and prioritization of new conservation projects and initiatives. The five stated objectives of the SCP are as follows:[19]

> 1) **Leverage existing protected landscapes: Create connectivity and buffers.** Connectivity of existing open space is a fundamental principle of conservation planning. [. . .] As climate change modifies fire regimes, maintaining land management flexibility will be increasingly important. Conservation of larger, unfragmented landscapes not only reduces the threat of fire from human activities, but also

[17] Department of Water Resources, California Water Plan 2013 Update: pp. MC-48, 49 (2013).
[18] State Water Resources Control Board, California Environmental Protection Agency, Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem, Prepared Pursuant to the Sacramento-San Joaquin Delta Reform Act of 2009 (August 3, 2010).
[19] Bear Yuba Land Trust, Strategic Conservation Plan, Working Draft February 2014.

gives land managers more flexibility to select management options that have a positive impact across the region. [. . .]

2) **Protect especially sensitive habitat.** Conserve and restore sensitive habitat areas for species migration upslope, particularly along riverine corridors. Protect important riparian, wetland and aquatic resources. Floral and faunal species will shift their distributions over time in response to changing climates. [. . .]

3) **Protect a healthy forest ecosystem.** Conserve forest lands in a way that maintains the long-term diversity and resilience of forest biological communities: trees, plants, wildlife, and also humans who make their living or recreate in the forest. Work to ensure that soil integrity and water quality are maintained. Support forest management strategies that reduce fuels to reduce the recurrence of catastrophic wildfires. [. . .]

4) **Protect agricultural lands.** Work with willing ranchers to permanently preserve agricultural lands. Support efforts to purchase agricultural easements and fund restoration projects. Focus on project connectivity.

5) **Develop publicly accessible open space.** Secure, develop and maintain publicly accessible open space lands for responsible passive recreation. Manage human impact in a way that does not degrade the land.

One of the BYLT's key initiatives is to "work with Yuba County Planning and Recreation departments to develop a conservation and recreation plan [for the Lower Yuba Gold Fields Conservation and Recreation Area]," and to "build off of collaborative work-in-progress between SYRCL, BYLT, and Western Aggregates." This initiative is aligned with projects currently being developed for the Gold Fields area as part of the IRWM process, and Objective 4.1 in this Plan "[p]romote[s] comprehensive recreation planning and implementation with a focus on regional economic development." Further, BYLT has also submitted two key projects during the IRWM process.

The SCP is highly compatible with the Yuba County 2030 General Plan Update and its goals to "protect agricultural lands, rural landscapes, air and water quality, and natural resource areas that prove to be positive characteristics of Yuba County." In the General Plan Update, Yuba County undertook an effort to re-examine its existing plans in the foothills that provide for urban or suburban levels of density "that may no longer be preferred for the county and should be re-evaluated in light of infrastructure feasibility, interests of the community." This re-evaluation came as a result of the failure of designated developments such as Yuba Highlands to move forward. The updated plan further defines a framework for this goal that includes "preservation of rural lifestyle," along with protection of agricultural lands and rural landscapes, and preservation of "foothill community boundaries that will continue to enhance and allow for open space, grazing lands, deer herds, and oak woodlands which define the rural character of the foothills and the County as a whole."[20]

Yuba County has defined Rural Community Boundaries (RCBs), which are existing historical communities within the foothill areas that allow for a long-term commitment to rural lifestyles and compatible agricultural uses. RCBs have a defined edge to prevent further encroachment into important grazing lands, deer corridors, oak woodlands, and/or valuable agricultural lands. RCBs include Loma Rica, Browns Valley, Oregon House, Dobbins, Rackerby, Brownsville, Challenge, Log Cabin, and Camptonville. These local plan policies and definitions support the mission of BYLT's SCP.

[20] Yuba County, 2030 General Plan Update (Adopted June 7, 2011).

Newly Acquired Conservation Lands

While conserved lands and land trust groups are not typically a part of the regulatory environment (though in certain large land development projects, they can play a role), their presence in the Plan area warrants discussion for their positive impacts on the local watershed. In the Plan area are two major land conservancy groups, the Bear Yuba Land Trust (BYLT) and the Trust for Public Land (TPL), both of whom are also part of the Northern Foothills Partnership, a collaborative conservation effort including BYLT, TPL, and Placer Land Trust. The Northern Foothill Partnership works to facilitate investment (generally consisting of acquisition and maintenance and monitoring of lands) in landscape-level conservation of the Sierra foothills and the Yuba and American River watersheds. Their conservation and, at times, restoration efforts are consistent with the local land use and water policies supporting habitat conservation, restoration, and enhancement, such as Wheatland's policies under Goal 8.B, Marysville's policies in their "Conservation and Preservation of Resources" General Plan section, and Yuba County's General Plan conservation policies under Goal NR1 and NR5 and its Critical Habitat and Water and Groundwater Recharge Areas open space designations. Objectives identified by the RWMG in the IRWM process also support the efforts of conservation groups, particularly those listed under Goals 2, 3, and 4.

While there are no newly acquired conservation lands within Yuba County proper, two large properties within the Yuba watershed have been recently acquired: Yuba Narrows Ranch and Black Swan Ranch, both located in far western Nevada County along the Lower Yuba River, adjacent to the Yuba County boundary. Bear Yuba Land Trust and the California Department of Fish and Wildlife (CDFW) are working together to conserve these ranches as part of a larger conservation project. The area includes oak woodlands, ponds, and wetland habitat, and provides habitat connectivity, permanent resource protection, and opportunities for public access for recreation. Ultimately the entire landscape will be transferred to CDFW for ownership and management.

The 530-acre Yuba Narrows Ranch includes almost two miles of frontage along the Yuba River, with acres of graveled spawning beds upon which the Chinook salmon population depends. CDFW, in concert with Trust for Public Land, acquired the Yuba Narrows Ranch in September 2011, ensuring it will be protected in perpetuity as publicly accessible open space.

Bear Yuba Land Trust acquired the 158-acre Black Swan Ranch to protect habitat connectivity for migrating wildlife and opportunities for public access to the Lower Yuba River for recreation, among other reasons. The intact wetlands of Black Swan Ranch are critical habitat for the western pond turtle, bass, and waterfowl, including the American dipper and belted kingfisher. Known special-status species on the properties include valley elderberry longhorn beetle, western burrowing owl, and black rail. Black Swan will also provide new recreational benefits with public access along the historic "Miner's Ditch Trail" which passes through both the Black Swan and Yuba Narrows Ranch. BYLT is planning construction of the trail and other public access amenities.

Directly across the river in Yuba County is the 5,700-acre UC Sierra Foothill Research Station. This conservation corridor links more than 10,000 acres of foothills oak woodlands including CDFW's Daugherty Hill Preserve allowing for north-south animal migration, and watershed protection. These projects are mentioned because they help implement the IRWM intention of sustaining watershed health and protection, and contribute to several Plan objectives.

Lower Yuba Accord

The Lower Yuba River Accord (Yuba Accord) was implemented as a pilot program in 2006 and 2007, and fully implemented in 2008. The Yuba Accord includes three separate agreements: the Fisheries Agreement, which

established higher minimum in-stream flows during specified periods of the year; the Conjunctive Use Agreements between YCWA and some of its member units, which integrate surface water and groundwater supplies with irrigation districts/mutual water companies; and the Water Purchase Agreement, which consists of the DWR and US Bureau of Reclamation's agreement to purchase water from YCWA to improve reliability for the State Water Project and Central Valley Project, including for fish and wildlife purposes, and to contribute to long-term EWA security. The Yuba Accord's in-stream flows may be modified when the Federal Energy Regulatory Commission issues a new long-term Federal Power Act license to YCWA for the Yuba Project during or after 2016.

Since full implementation in 2008, the Yuba Accord has resulted in significantly higher in-stream flow requirements for salmon and steelhead on the Lower Yuba River, an average of over 100,000 af of water transferred for fish and wildlife in the Bay-Delta estuary and for cities and farms throughout the state, and water rights protections for local farmers in Yuba County. Minimum in-stream flows are generally met in the Yuba River in compliance with the Yuba Accord. However, this may become more difficult as warming and drying of the climate is projected to reduce regional surface flows in some streams and future state water regulations and policies are uncertain. Furthermore, the Yuba Accord's in-stream flows may be modified when FERC issues a new long-term Federal Power Act license to YCWA for the Yuba Project (FERC #2246) during or after 2016.

A 21st Century Assessment of the Yuba River Watershed

In January 2011 the South Yuba River Citizens League, one of the region's most prominent NGO advocates for Yuba River watershed health, released its 21st Century Assessment of the Yuba River Watershed. This report includes an evaluation of the watershed health, describes the major contributing factors that impact watershed health, and prioritizes restoration actions to remediate issues within the watershed. Its restoration priorities are as follows:

1. Remediate legacy mining effects (including issues with hazards of abandoned mine lands, sediment-trapped mercury behind in-stream barriers, and Lower Yuba River rehabilitation).
2. Reform water management (including improve the timing and amount of in-stream flows through the FERC process and multi-basin water planning and removing in-stream barriers where appropriate).
3. Restore forest function (including fuel load reduction, support of a biodiverse, mixed-aged forest structure, soil rehabilitation, cessation of clearcutting and logging in riparian corridors, road removal, and control of invasive species).
4. Restore meadow function (including high elevation meadow restoration and control of invasive species).
5. Restore floodplain function (including rehabilitation of the Lower Yuba River).

Plan objectives 2.4, 2.7, 3.1, 3.2, 3.3, 3.5, and 3.6 are generally consistent with the restoration priorities above. Though the RWMG did not identify objectives and performance metrics that directly address all of the restoration priorities, individual projects of the IRWM process work to implement and support the restoration priorities.

10.1.1.7 Low-Impact Development Strategies

Low-impact development or LID strategies are storm water management strategies aimed at maintaining or restoring the natural hydrologic functions of a site to achieve natural resource protection objectives and fulfill environmental regulatory requirements. LID strategies employ a variety of natural and built features to reduce

the rate of surface water runoff, filter pollutants out of runoff, and facilitate infiltration of water into the ground. Typical LID measures include using pervious pavements and green roofs, dispersing runoff to landscaped areas, and routing runoff to rain gardens, cisterns, swales, and other small-scale facilities distributed throughout a site. Interference with natural watershed functions can be minimized, and impacts on groundwater recharge, surface water quality, and flood hazards can thereby be reduced through appropriate implementation at development sites. LID measures are most effective when incorporated into a project design during initial site layout and configuration.

Yuba County's General Plan Update includes a description of LID strategies and applies them in Action HS3.2, which states that the county will revise its development standards to incorporate LID strategies as voluntary or mandatory measures. Included LID strategies are: naturalized drainage swales, pervious driveways, pervious parking areas, tracked driveways, and other strategies that maximize onsite filtration and treatment of storm water. The IRWMP Update suggests urban water conservation measures as adaptive strategies for climate change.

10.1.1.8 Salt and Salinity Management

Central Valley Salinity Alternatives for Long-term Sustainability (CV-SALTS) is a multi-stakeholder process in the Central Valley to address the long-term build-up of salts and nitrate issues in the Central Valley. Through this collaborative process, stakeholders, including the RWQCB, are developing a Central Valley Salt and Nutrient Management Plan (SNMP) and associated Basin Plan amendments to implement the SNMP.

The RWQCB has begun to include permit requirements to "actively participate in CV-SALTS" in Central Valley permits. Additionally, the Statewide General Landscape Irrigation Permit for recycled water requires enrollees to participate in regional salt and nitrate planning. CV-SALTS has developed guidelines to allow entities to participate through membership agencies, such as Central Valley Clean Water Association (CVCWA), or as individual agencies. Participation includes both active participation in meetings and contributions, either through the Central Valley Salinity Coalition, the funding arm of CV-SALTS, or in-kind services.

In December 2012, the CVCWA board established the CV-SALTS Special Project. The primary purposes of this special project are to support CVCWA's membership in CV-SALTS and the Central Valley Salinity Coalition (CVSC); and provide regulatory credit for "active participation in CV-SALTS" through CVCWA to agencies participating in this special project.

10.2 Coordination Between Local Land Use and Water Planning

The IRWMP project team has observed that there is already a high degree of coordination between local land use and water planning. This is due in large part to YCWA's leadership in resolving water-management issues (including those identified in this Plan), their presence in the RWMG, and their capacity to convene and facilitate adaptive management strategy discussions. YCWA and its member units, Yuba County, and the City of Wheatland have a strong collaborative relationship, and all these local jurisdictions are represented on the RWMG. The City of Marysville is not represented on the RWMG, but does collaborate with other local jurisdictions on some water-planning issues, such as its collaboration with Yuba County in 2004 on the Storm Water Management Plan.

YCWA has a long history of actively managing the county's water resources for beneficial use in cooperation with its member units, stakeholders, and local, state, and federal agencies. An example is the YCWA's contribution to reversing a potentially serious overdraft situation in the South Yuba subbasin. Between 1948 and 1981, groundwater elevations in the South Yuba subbasin declined an estimated 130 feet. In 1984, YCWA began delivering surface water from its New Bullards Bar Reservoir to the subbasin to offset groundwater extraction, resulting in a groundwater elevation rise to near-historical levels. YCWA's commitment to maintaining and updating their GMP will feed into the IRWM process as updates will provide opportunities for ongoing evaluation of consistency between the IRWM and GMP. These collaborative practices are formalized in the GMP Basin Management Objective that aims to improve communication and coordination among Yuba groundwater basin stakeholders to make groundwater users and interested parties aware of those activities.

In its adopted determinations, the Yuba Local Agency Formation Commission Municipal Service Review encourages multi-jurisdictional planning and collaboration to determine how future development will be served. At the same time the MSR found that "the County, the cities, Yuba County Water Agency (YCWA), Browns Valley Irrigation District (BVID), and the fire districts demonstrated a high degree of public participation in elections as well as other forms of citizen participation," and that "water purveyors practice extensive facility sharing. Camp Far West Irrigation District (CFWID) relies on water production and conveyance facilities operated by South Sutter Water District. NYWD relies on water production and conveyance facilities operated by South Feather Water and Power Agency. Ramirez Water District (RWD) relies on conveyance through Hallwood Irrigation Company and Cordua Irrigation District (CID) canals for distribution, and share responsibility for the fish screen." [21] The current facility sharing and public participation in public processes demonstrates that scaffolding is in place to support further collaboration and participation. No problems regarding lack of coordination between local land use and water planning entities were identified during the preparation of this Plan Update, although Marysville Planning Department did not respond directly to contact from the project team (see following section). Further, going forward, coordination will be enhanced between and among relevant planning entities both by participation on the RWMG and by the Yuba County IRWMP website.

10.2.1 IRWMP Relation to Local Land Use Planning

Land use trends in Yuba County have shifted from agricultural uses to residential land development for several decades, with the most recent residential influx occurring from the 1990s to the early 2000s. Most growth has occurred in unincorporated areas of the valley floor in the vicinity of Olivehurst, Plumas Lake, Linda, Wheatland, and the State Route 65 and 70 corridors. Future growth is anticipated in the same areas with large swaths of agricultural land designated for urban development. Yuba County's population is expected to increase from 72,155 in 2010 to 143,973 in 2050, a twofold increase that equates to an average growth rate of approximately 2.5 percent.[22] Even with this development, however, agricultural use predominates the valley landscape, and agricultural activity still represents the most significant economic activity in the county.[23]

For the purposes of this discussion, it is important to note that areas of heaviest water use, irrigated croplands, are found in the areas of prime agricultural soil in the western valley floor area of the county along the historic floodplain of the Yuba and Feather Rivers due to the relatively flat topography, water supply, and soil conditions. These areas are predominantly zoned Exclusive Agricultural, and much of the land in these areas is

[21] Yuba Local Agency Formation Commission, Municipal Service Review (Adopted July 24, 2008).
[22] US Census Bureau, quickfacts.census.gov; California Department of Finance, www.dof.ca.gov
[23] Yuba County, Yuba County 2030 General Plan (Adopted June 7, 2009).

also considered Prime Farmland, Farmland of Statewide Importance, and Unique Farmland under the state's Farmland Mapping and Monitoring Program. [24]

The foothills and mountain areas include land that has been traditionally used for natural resource production, including grazing, timber production, and mining, though rural residential development is an increasing part of the foothill and mountain landscape. Agricultural landscapes comprise 51 percent of the Plan area, while urbanized uses comprise 16 percent, resource extraction 3 percent, and public lands, such as Beale AFB, 23 percent. Grazing lands, which are typically not heavily irrigated though they are agricultural uses, are found primarily in the central and eastern portions of the county and in the foothills of the Sierra Nevada Mountains, although some grazing also occurs on uncultivated portions of the valley floor. Livestock grazing also occurs in the Plumas and Tahoe National Forests.[25] Rural residential development is an increasing part of the foothill and mountain landscape.

Growth within the City of Marysville is largely constrained by a circular system of levees developed in the 1960s to protect the city from frequent flooding that occurred due to the fact that Marysville is below common flood levels and is located at the confluence of the Feather and Yuba Rivers. This location, however, makes their water situation unique in that surface water could be easily developed if groundwater resources were limited.

The valley region of the Plan area is dominated by agricultural and urbanized areas and includes Beale AFB, Marysville, Wheatland, and developed unincorporated areas. Similar to historic growth patterns, future growth is anticipated to be greatest in the valley region of the Plan area, especially around Olivehurst-Plumas Lake, Linda, Wheatland, and the State Route 65 and 70 corridors. The 2030 Yuba County General Plan designates 24 percent of the county with urban uses, with urbanized uses increased 50 percent from the previous General Plan. Accompanying the increase in residential development is a high rate of farmland conversion to residential uses. According to the USDA's 2007 Census of Agriculture, from 2002 to 2007, 73,231 acres of farms were lost (from 234,129 acres to 160,898 acres of farms), resulting in a 31 percent decrease in farmland in only five years.[26] As discussed in the previous section on water planning, conversion of agricultural uses to residential uses results in reduced water use.

10.2.1.1 Current Relationship Between Land Use and Water Planning Entities

Land use planning is conducted within the region by Yuba County, two cities (Marysville and Wheatland), a resource conservation district in conjunction with a watershed group, the US Forest Service (for Tahoe and Plumas National Forests), the Bureau of Land Management, and CalFire. Land use planning is conducted by the counties for unincorporated lands and by the cities for incorporated lands. Much of the public land is also planned and administered by the National Forests.

The project team for the IRWMP Update interviewed local land use agencies to determine current inter-agency relationships and procedures. The US Forest Service and local jurisdictions of Yuba County, Marysville, and Wheatland (by staff members of their respective Public Works Departments) have been represented in the RWMG. The local agency representatives have coordinated internally with their respective Planning Departments to ensure that issues, concerns, data, and other relevant considerations from Planning were integrated into the document. Yuba County and Wheatland Planning Departments have been responsive in providing information requested for this chapter, while the Marysville Planning Department did not respond directly to communications from the project team.

[24] Yuba County, 2008 General Plan Update Background Report: Agriculture.
[25] Yuba County, 2008 General Plan Update Background Report: Agriculture.
[26] USDA, Natural Agricultural Statistics Service, 2007 Census of Agriculture: Yuba County, California.

The Yuba County Planning Department has indicated that the 2008 Yuba IRWMP was incorporated into the Yuba County 2030 General Plan Update by reference, and that the Public Health and Safety Chapter of the General Plan discusses available information, goals, and policies related to water quality and flooding. When project applications are received, the Planning Department notifies service agencies, including applicable water purveyors and other governmental regulatory agencies. Those entities may then submit comments, requests for additional information or studies, concerns, and potential conditions they would like to impose on the project. Yuba County complies with state requirements under SB 221 and SB 610 (see "Water Supply Assessments" section of this chapter). For large subdivisions of 500 or more units, the applicant must work with the water provider that services the project to prepare a WSA in compliance with SB 610. For smaller projects, the water provider is notified of the application and given an opportunity to provide comments and conditions.[27]

The City of Wheatland, via its Public Works Department, provides municipal water to all of its residents via groundwater wells. According to planning staff, the City of Wheatland Public Works Department regularly assesses and maintains the city's groundwater wells. Wheatland does not have any adopted water planning documents, but as previously noted is working with the Sierra Business Council to conduct a greenhouse gas inventory that will be used in the preparation of a climate action plan.[28] City of Wheatland planning staff have indicated that it is assumed that groundwater will be available to meet the needs of new development. The City of Wheatland has not prepared a groundwater study; however, during preparation of the Johnson Rancho and Hop Farm Annexation EIR, Wheatland prepared a WSA for the Johnson Rancho and Hop Farm Annexation project, which included analysis of the groundwater basin. No jurisdictions identified problems of coordination among or between local water and land use planning entities.

10.2.1.2 Programs, Policies, Standards, and Procedures

The updated IRWMP also includes a review of the water and land use planning policies and programs of other governmental and NGO entities.

US Forest Service Land Use Plans

US Forest Service planning documents provide guidelines and management direction for the upper watershed regions of the Yuba County IRWM Plan Area. The 2004 Sierra Nevada Forest Plan Amendment lays out broad management goals and strategies for addressing five issue areas in the dozens of complex ecosystems within the Sierra Nevada: old forest ecosystems and associated species; aquatic, riparian, and meadow ecosystems and associated species; fire and fuels management; noxious weeds; and foothill oak woodland ecosystems. In addition, the 2012 Planning Rule for land management planning for the National Forest System became effective on May 9, 2012. The Forest Service has subsequently released proposed planning directives, which are the key set of agency guidance documents that direct implementation of the 2012 Planning Rule, for public review and comment. The directives are expected to be formally adopted in the near future.

The 1990 Tahoe National Forest Land and Resource Management Plan and the 1998 Plumas National Forest Land and Resource Management Plan directs the management of their respective National Forest lands. The purpose is to guide efficient use and protection of forest resources, fulfill legislative requirements, and balance local, regional, and national needs. The plans describe the current management direction, supply or

[27] Boeck, Van, Yuba County Department of Public Works and Wendy Hartman, Yuba County Planning Department, email communication to Jessica Hankins (April 9, 2014).
[28] Pappani, ibid.

production capability, existing and projected demands for forest goods and services, and the need or opportunity for changes in current management direction. Applicable resource areas discussed include recreation, fish, wildlife, and sensitive plants, diversity, riparian areas, water, ownership, land uses, and the urban/rural/wildland interface. The plans also present both forest-wide and area-specific management direction for the National Forest lands.

California Environmental Quality Act

Land use planners must also consider the environmental impacts of a development project during their California Environmental Quality Act (CEQA) evaluations, which assess the physical impacts of any given project. Impacts to water quality, water supply (including groundwater availability), and flooding are all evaluated for any project that has the potential to have a physical impact on the environment. As part of the IRWM project development process, project sponsors must conduct a CEQA evaluation to assess the physical impacts of their projects. Additionally, project-specific performance measures are frequently established as a result of that CEQA process.

Williamson Act

The California Land Conservation Act, better known as the Williamson Act, is a statewide agricultural land protection program that reduces property taxes on qualifying agricultural land in exchange for a commitment from the landowner not to develop the land with uses other than those compatible with and supportive of agriculture. This tax incentive preserves agricultural and open space lands by discouraging premature conversion to urban uses. Counties may choose to participate in the program or not participate. As a result of reduced state subventions to counties, Yuba County has chosen not to participate in the Williamson Act. [29]

Yuba County LAFCO Municipal Service Reviews

In 2000 California adopted the Cortese-Knox Hertzberg Act (AB 2838) requiring Local Agency Formation Commissions (LAFCOs) to review and update the spheres of influence of cities and districts in their jurisdiction once every five years. Before each sphere of influence review and update, LAFCO must comprehensively review municipal services in the county, resulting in a Municipal Service Review (MSR) of public services such as water, fire protection, and reclamation. An MSR provides comprehensive knowledge of available services, future needs for each service, and the efficiency and expansion capacity of service providers.

In 2008 Yuba County adopted MSR determinations, which are a set of observations, facts, and recommendations related to the existing and future provision of public services in the unincorporated areas of the county. A sampling of determinations related to water issues in the Plan area are highlighted below:[30]

- YCWA reported that it does not anticipate having water supplies to serve municipal and industrial demands. The cities, the county and the urban water districts should evaluate groundwater adequacy and irrigation practices in their SOIs and future growth areas before the next MSR cycle.
- As a result of groundwater overdraft in the Wheatland Water District (WWD) area, well yields are low in the area north of Dry Creek. Surface water supplies are needed and related canal infrastructure is being developed by YCWA.
- In the long-term, future urban development may need access to treated surface water to ensure adequate and reliable water supply. Due to historic overdraft of the South Yuba Groundwater Basin,

[29] Yuba County, General Plan Update Background Report on Agriculture, 2008.

[30] Yuba Local Agency Formation Commission, Municipal Service Review (Adopted July 24, 2008).

there may be inadequate groundwater supplies to serve planned development in the long-term. Actual impacts on the groundwater subbasin would depend greatly on the extent of existing surface and groundwater use on land that would be urbanized in the future.

- Enhanced groundwater monitoring and planning is needed to ensure adequate and reliable water supplies are available throughout the area.
- A diversified water portfolio, including both surface and groundwater for future municipal needs, would help boost drought and emergency preparedness in urban areas. Use of surface water may also benefit wastewater providers by reducing salinity, particularly in light of evolving regulatory standards.
- Expanded YCWA programs, including conjunctive use, groundwater monitoring and analysis, and land subsidence monitoring, are desirable.
- Urban development will tend to reduce overall water needs in southern Yuba County. Comprehensive analysis of demand, not only for imported water but also for local sources, is a recommended practice. Comparison of projected demand growth to both regional and local demographic and economic forecasts also helps ensure responsible planning of water purveyors.

The MSR also indicates that "[l]and use planners in high-growth areas should periodically update development plans and growth projections; this could be included in the five-year housing element updates. Increased communication between land use and infrastructure planners is needed to ensure that long-term water and transportation planning accounts for the future needs of the area."

These determinations are consistent with RWMG, YCWA, and Yuba County findings and policies as well, which emphasize need for collaboration between land use and water planning due to uncertainties of water supply into the future. Pursuant to the requirements of the Cortese-Knox Hertzberg Act, the MSR will likely be updated again in the near future, providing additional opportunities for coordination regarding MSR determinations and IRWM objectives.

Local General Plans and Other Municipal Planning Documents

California state law requires each county to adopt a general plan, "for the physical development of the County and any land outside its boundaries which ...bears relation to its planning" (Government Code Section 65300). The General Plan serves as the county's constitution for the physical use of the county's resources and is the foundation upon which all land use decisions are made. The general plan expresses the community's development goals and embodies public policy relative to the distribution of future public and private land use. Planning and land use play a vital role in water use and distribution, and as such will influence infrastructure needs, water demand and supply, and impacts on natural systems addressed in the Plan.

Yuba County and the Cities of Wheatland and Marysville have prepared General Plans as follows:

- Yuba County General Plan Update 2030 (June 7, 2011)
- City of Wheatland General Plan (July 2006)
- City of Marysville General Plan (August 1985)

Given that they have been only recently updated, the Yuba County and City of Wheatland General Plans may not be updated again for some years, with most general plan updates (aside from the Housing Element) being updated only once every 20 years or so, on average. However, as the General Plans are updated, there will be opportunities for collaboration between land use planners, water managers, and the RWMG to consistently plan for water resource management issues. Further opportunities for synchronized efforts at land use and water planning can occur more often with the adoption of new or revised Zoning Ordinances, which often implement the goals and objectives of the General Plans.

Although Yuba County has defunded its Parks and Recreation Department, it has prepared a Parks Master Plan (2008). This plan evaluates the county's current park and recreation resources, assesses needs for the future, and presents strategies and implementation tools to achieve the goals laid out by the stakeholders. Key aspects of the watershed play significant roles in the current and proposed park system, including Riverfront Park, open space areas, trail routes, and waterfront access to the Yuba and Feather Rivers. Several regional projects, including new parks and improvements to existing parks, as well as new trails, are proposed along the Yuba and Feather Rivers. A Yuba River Regional Park is proposed in the aggregate mining area of the Gold Fields, once the site is reclaimed. Goal 4c of the Parks Master Plan provides consistency between the Master Plan and regional water and land use planning goals: "Use natural areas for multiple purposes, including buffering land uses, managing storm water, habitat and recreation use."[31] This goal supports IRWM objectives that would strengthen watershed health, water quality, flood protection, and recreational uses.

During the issuance of building permits, applicants must comply with local, state, and federal statutes addressing erosion control and storm water management. Local development standards, codified by the local jurisdictions' zoning or municipal ordinances, are the on-the-ground implementation measures used to enact these protections.

10.2.1.3 Consistency between IRWMP and Local Plan Goals

Appendix 10-1 illustrates the local planning goals and policies that were reviewed to ensure that the goals and objectives of the Yuba County IRWMP are compatible with and support local planning efforts. These documents were reviewed to support development of the Yuba County IRWMP's updated objectives and projects. Their consistency with the IRWMP and water planning documents is discussed further under Section 10.2.

During a review of relevant local general plans, a consistent difference in emphasis was present between the IRWMP and the relevant plans on issues such as climate change and associated impacts on water supply and habitat. Goals and objectives were more strongly stated in the IRWMP than the General Plan. By way of example, Yuba County General Plan Policy CD11.2 states that "particular local advantages" include "excellent water quality and plentiful supply," and Policy HS3.2 defines beneficial uses of water as supply for human-based needs. This difference may arise from the fact that the IRWM Guidelines require a similar level of emphasis on the approaches to water management issues. The IRWMP presents issues, goals, and objectives with an equitable focus on human and environmental beneficial uses, and human safety and environmental stewardship.

On many topics, however, the RWMG identified issues similar to those shown in the City of Wheatland and County of Yuba General Plans. For example, regarding groundwater, the RWMG found that the need to "promote integrated management of groundwater and surface water" was a significant issue. The Yuba County General Plan Update Policy NR12.1 states that "the County will manage land use change in a way that reduces the potential for overdraft of groundwater supplies [. . .] and helps to ensure that the combined use of surface and groundwater resources provides for current and future water demand." City of Wheatland General Plan Policies 5.C.1 and 5.C.2 require that the city protect the groundwater basin from overdraft using such strategies as conjunctive use and recharge programs, water conservation measures, reuse, and surface water supplements. Similar parallel measures were absent from the City of Marysville General Plan.

[31] Yuba County, Yuba County Parks Master Plan (Adopted February 19, 2008).

The RWMG also supported "water conservation and water use efficiency by instituting various techniques including, but not limited to, groundwater recharge, conjunctive management, irrigation efficiencies, municipal water conservation, water recycling and reuse" (Objective 12). Yuba County's General Plan likewise promotes water conservation through Policies NR 12.4 through 12.7, which encourage or require the use of recycled water for non-potable uses, climate-appropriate landscaping and water-conservation technologies and devices in new developments, and financial incentives for developers to use recycled water systems in their projects. Wheatland General Plan Policy 5.C.3 also promote "efficient water use and reduced water demand" in new construction and development using similar measures as those suggested by Yuba County. Wheatland Policy 5.C.4 supports water conservation in both urban and agricultural settings throughout the county. Again, similar parallel measures do not occur in the City of Marysville General Plan.

All local plans and the IRWMP supported goals of enhancing water quality, flood control infrastructure, and water supplies that supported recreational uses while minimizing impacts on water quality and offered multiple benefits such as recreational, ecosystem, and agricultural benefits.

10.3 Plan Relation to Neighboring Regional Planning Efforts

There are four IRWM planning areas which are directly adjacent to the Yuba County IRWM region: Cosumnes American Bear Yuba (CABY), Upper Feather River Watershed, North Sacramento Valley Four County Group, and American River Basin. During the preparation of this Plan, each of these regions was contacted, both formally (see **Appendix 4-1**) and informally (via meetings at events, conferences, and workshops). As a result of this initial outreach, the various regional representatives agreed to continue to coordinate with the Yuba County IRWM via scheduled meetings at least annually, phone conversations as needed, conversations via the Sacramento Region Funding Area group, attendance at RWMG meetings as requested, and through casual meetings conducted opportunistically at regional events and conferences such as the Sierra Water Work Group, the Association of California Water Agencies, and attendance at DWR-sponsored workshops. Issues of common concern are many, including, but not limited to, flooding, water supply, fisheries, and climate change. The adjacent regions have not yet begun to systematically focus on the options for inter-IRWMP project development coordination. The Yuba County RWMG will endeavor to catalyze this more nuanced and coordinated approach to project development. More information on next steps in regional collaboration is contained in Chapter 4 *Coordination.*

10.4 Coordination with State and Federal Planning Efforts

Ongoing collaboration with relevant federal and state agencies will continue after Plan finalization. Efforts will include coordination with the RWQCB on issues relating to salinity (via CV-SALTS), coordination with the SWRCB efforts to establish flow requirements for water coming from rivers that flow into the Delta to meet the Delta's restoration and water supply goals, tracking and coordination with the WMI approved as part of the 1995 SWRCB Strategic Plan, continued partnership with DWR to finalize and implement the FRRFMP, and ongoing meetings with the Tahoe and Plumas National Forests on fuel-load reduction and forest management, and participation in emerging regionally focused efforts aimed at aspects of water supply, water quality, and environmental stewardship.

Finally, the Yuba Salmon Forum/River Management Team is an example of an existing venue which exists to promote state, federal, and local coordination and collaboration on issues of mutual concern. The group includes representatives of the signatory groups—YCWA, National Marine Fisheries Service, US Fish and Wildlife Service, Bureau of Reclamation, California Department of Fish and Wildlife, DWR, and four NGO

signatories (including SYRCL) to cooperatively manage the flows of the Yuba River according to certain guidance criteria, and also allocate funds for the monitoring and evaluation of the condition of fish and fish habitat.

10.5 Recommendations to Improve Coordination

As described in Chapter 3 *Stakeholder Involvement*, at the outset of the IRWMP Update process, stakeholders with an interest in the Plan area's water issues were identified through various outreach and engagement strategies. During subsequent interviews and meetings with interested stakeholders who became part of the RWMG, the project team was able to identify regional issues and water-related conflicts. The RWMG identified the significant water management issues in each zone of the Plan area: in the lower watershed, flood management, water quality, and water supply reliability were the major issues identified; in the upper watershed region, wildland fires, along with attendant erosion and sedimentation issues, and water supply reliability are the primary water management issues.

During the circuit-riding meetings, the project team contacted and met with Plan area planning agencies. With the exception of the City of Marysville and Beale AFB, these agencies have been active participants in the IRWM process and RWMG meetings. The RWMG creates a convergence point for future collaboration during its annual meetings. Meetings are formatted to elicit discussion and problem-solving of emerging issues. Outreach should continue to Marysville and Beale to include these agencies in future conversations about water and land use planning issues under the auspices of the RWMG and its website.

The RWMG has discussed potential climate change impacts on groundwater and surface water supplies, and these conversations have involved Wheatland and the county. If in the future residential development becomes dependent on surface water, then the relationships established via the RWMG will support full collaboration and coordination among those entities. At the same time, there are so few land use and water planning entities in the Plan area that coordination is today already functional, with reviews of new developments distributed to water agencies for review and input. Informal, one-on-one communication is the norm for the region, and the RWMG formalizes that communication and provides certainty of ongoing discussion and meetings.

Chapter 11 *Climate Change*

11.0 Introduction and Overview

The intent of this chapter is to array observed and projected climate trends and impacts affecting or potentially affecting the Yuba County IRWM region. Climate is defined as "[t]he expected average conditions, plus the characteristic range of variability of those conditions." Climate change, therefore, is the expected degree and amount of variation in climate characteristics as compared to that historic norm.[1] The State Department of Water Resources (DWR) defines climate vulnerability as the ". . . degree to which a system is exposed to, susceptible to, and able to cope with and adapt to, the adverse effects of climate change." Recent studies on prehistoric climate show prolonged and extensive droughts have occurred in California, but the following section addresses the historic record to better facilitate water management over the 20-year horizon of this Plan.

Through stakeholder involvement and deliberation, as well as technical expertise and familiarity with local conditions, the Yuba County IRWM region will be more resilient to climate impacts and better able to prevent negative effects related to human health and the local economy, as well as damages to natural resources.

Climate trends and projections indicate the following climate effects for the Yuba County IRWM region:

- reduced streamflow and water supply in the long-term that will generate hard choices for water managers, and potentially increased conflicts between human and environmental uses;
- reduced water quality from the direct effects of rising temperatures and the indirect effects of eutrophication, increased algal growth, release of mercury methylation, increased sedimentation from increased winter runoff, and decreased vegetative cover due to fire;
- increased flooding with greater storm intensity and higher winter precipitation;
- inability of water infrastructure designed for a historic flow regime to accommodate increased winter peak flows;
- increased wildfire potential and, in particular, catastrophic wildlife with consequences for forest function, ecosystem health, and social and economic costs;
- upslope movement of vegetative communities as temperatures rise;
- potential fragmentation and/or degradation of habitat for stream-dependent species and elevationally dependent species in particular (species restricted in their ability to move or re-adapt);
- greater colonization and numbers of both terrestrial and aquatic invasive species;
- reduced viability for heat-sensitive crops—berries, mandarin oranges, grapes, and apples—and a potential reduction in agro-tourism, although alternative crops may begin to be viable here; and
- effects on the region's recreation industry from lower summer flows, both rafting and reservoir-based use.

Stakeholders and the project team considered these trends and effects, determined likely regional climate vulnerabilities, and offer below a range of adaptation strategies to reduce climate impacts and increase regional climate resiliency.

[1] Starr Consulting, Palencia Consulting Engineers, and Talavera & Richardson. American River Watershed Survey (December 2008).

11.1 Process for Preparing This Chapter

To support its Robust Decision Support (RDS) process (see section 11.1.1), an advisory Core Group was formed by Stockholm Environmental Institute (SEI) in June 2013, made up of individuals from the main interest groups involved in the Regional Water Management Group (RWMG). The Core Group subsequently agreed to act as a technical advisory committee for the IRWMP climate analyses. The Core Group includes representation from Yuba County Water Agency (YCWA), Brown's Valley Irrigation District, North Yuba Water District, City of Wheatland, Hallwood Irrigation Company, Yuba County Community Development and Services Agency, South Yuba River Citizens League (SYRCL), and AquAlliance.

The initial stages of chapter preparation involved data gathering, both by SEI and the project team conducting an extensive literature and data search and stakeholder interviews. (Primary sources of this search are included in Chapter 19 *Technical Analysis and Data Management*.) The gathered climate information led to: 1) a draft synthesis of potential climate trends and impacts, vulnerabilities, adaptation strategies; and 2) a refinement of the framework of inquiry for future Water Evaluation and Planning (WEAP) hydrologic modeling from the Core Group's informed participation.

Draft narratives and background materials of climate vulnerabilities were prepared for review, and a vulnerability checklist based on the DWR's Climate Handbook (see **Appendix 11-1**) was populated with information from the data collection effort and then presented to and refined by stakeholders. Meanwhile, the SEI team continued to engage the Core Group in meetings to consider and refine influences on its hydrologic modeling, including climate.

In March 2014, the Core Group met to consider and amend the posted climate materials and to prioritize regional climate vulnerabilities under a directed exercise by the project ream that evaluated both the severity of the risk and likelihood of occurrence of vulnerabilities. The recommended prioritization was forwarded to the RWMG as part of the draft climate chapter, and is included in section 11.3.2, below.

Because the timeframe for SEI's modeling was to extend beyond the preparation period for this Plan, and because that modeling had the potential to define new as well as refine draft adaptation strategies, the Core Group made the decision not to prioritize specific adaptation strategies at this time.

Where projects were sufficiently developed, the project team conducted greenhouse gas (GHG) emission calculations. These calculations are included in **Appendix 14-4**. A summarized list of climate vulnerabilities also was briefly discussed with potential project sponsors when the project team conducted project recruitment. This served as a means of incorporating climate mitigations into implementation projects. The identification of vulnerabilities and adaptation strategies is, therefore, a culmination of several endeavors to both identify and display climate information. A side benefit of the process has been an expansion of stakeholder climate knowledge and development of projects that incorporate climate adaptations and mitigations.

11.1.1 The Role of the Robust Decision Support Process in IRWMP Preparation

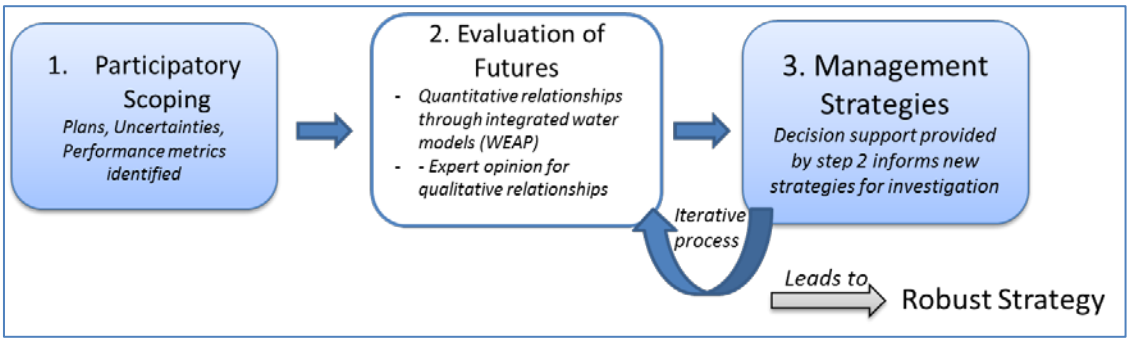
As mentioned above, a parallel process for improving regional water management decision-making was being conducted during the preparation of this Plan by SEI. RDS applies a participatory framework[2] to integrate the natural, social, and political aspects of water resource management in a quantitative model IWRMP. Water demand across sectors—agriculture, industry, energy, urban, environment—is affected by climate variability and further complicated by social and contractual issues among many users in the Yuba County IRWM region. These factors are difficult to integrate because social, political, and economic boundaries often overlap watershed boundaries and other physical delineations critical to water resources systems.

In brief, the RDS process allows the following:

- consideration of many possible futures (an ensemble) rather than a single best estimate;
- prioritization of strategies that perform well across many possible futures rather than for one particular future; and
- adaptive strategies for changing conditions.

RDS employs water resources computer models (in this case, using WEAP) and rich visualization of possible futures (in this case, using Tableau). The three steps of RDS are shown in **Figure 11-1** and described in detail in **Appendix 11-2**.

Figure 11-1. The RDS Process



The Core Group used this process in evaluating vulnerabilities and adaptation strategies for the region. Since the RDS process will be conducted over a longer timeframe than preparation of the IRWMP, updates to the IRWMP will accommodate any relevant information produced by the RDS process, after Plan preparation.

11.1.2 State Climate Strategies/Documents

In preparation for evaluating potential vulnerabilities and adaptive management strategies for the region, the project team reviewed the four primary source documents, as required by DWR in the IRWM Guidelines (see **Table 11-1**). These documents are intended to implement several state policies and legislative acts aimed at addressing the effects of climate change and reducing GHG emissions. The

[2] This approach has been shaped by the academic literature on decision-making under deep uncertainty, most significantly by the Robust Decision Making approach described in "Shaping the Next One Hundred Years" by Lempert, Popper, and Bankes (2003). Santa Monica, CA. 187 pp. RDM is a process rather than a fixed set of practices, and SEI uses the term Robust Decision Support for its rendition of RDM, to emphasize both its own rendition of RDM, as well as the fact that our goal is to support decision-making, not to make decisions for stakeholders.

results of this review informed both the process and the content of the climate change evaluation. These documents included the following:

- Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water
- 2009 California Climate Adaptation Strategy
- Climate Change Scoping Plan
- Climate Change Handbook for Regional Water Planning

Table 11-1 describes the recommendations of the respective documents and briefly discusses how each document affected or was incorporated into this Plan.

Table 11-1. State Plans' Influence on the Climate Change Analysis		
Plan	**Requirements/Focus**	**Impact of State Plans on the Climate Change Analysis**
Climate Change Scoping Plan AB 32 directed the California Air Resources Board (CARB) to adopt regulations implementing actions to reduce greenhouse gases by 2020, and to prepare a Scoping Plan to achieve those reductions, including actions related to water management.	**Recommends specific strategies with a goal of cutting 15% from today's GHG emission levels via regulations, market mechanisms, and voluntary measures.**	Recommended actions most relevant to the Plan were considered by stakeholders as part of issue identification, evaluation of applicable resource management strategies, development of goals and objectives, and the project development and integration process, and are listed below: 16. Sustainable Forests – Encourages maintaining forest GHG sequestration levels, implementing sustainable land use practices, biomass projects, reducing the risk of wildfire, and conservation of the forest land base. 17. Water – Promotes water use efficiency, water recycling, water system energy efficiency, reuse of urban runoff, increase renewable energy production, and a public goods charge. 18. Agriculture – Encourages investment in manure digesters at dairy farms, fuel-efficiency of on-farm vehicles, water-use efficiency, and biomass for power production. Enhancement and restoration of riparian woodlands is suggested for carbon sequestration. Please see section 6.1 for a discussion of strategy implementation within the region.
Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water This document assesses climate effects on water resources across California and offers adaptation strategies to mitigate climate impacts on those resources.	Presents 10 strategies for adaptation measures.	This document was most applicable when considering overall climate trends and adaptive strategies for the region. The Yuba County IRWM region is employing three of the ten strategies presented in the report: ▪ **Strategy 1: *Provide Sustainable Funding for Statewide and Integrated Regional Water Management* – YCWA has provided match that helped prepare this IRWMP. Chapter 15 *Finance* explains how the Plan and its projects will be implemented.** ▪ **Strategy 2: *Fully Develop the Potential of Integrated Regional Water Management*: The preparation of the Plan and the participation of stakeholders in its development, adaptation strategies, and implementation project processes will contribute to full development potential of IRWM.** ▪ ***Aggressively Increase Water Use Efficiency:* Marysville, Olivehurst PUD, and Linda County Water District submitted 2010 Urban Water Management Plans whose average per capita use projections decrease to meet California's "20 percent by the year 2020" water use targets.**
2009 California Climate Adaptation Strategy Executive Order 2-13-08 directed state management of climate impacts from sea level rise, increased temperature, altered precipitation, and extreme variation in weather events.	Discusses how to assess vulnerabilities and outlines adaptation strategies.	**The strategy's principles were considered and incorporated into this planning process:** ▪ **Reduction of per capita water use 20% by 2020, including agricultural water use efficiency.** ▪ **Project alternatives that avoid new development in areas prone to flooding, wildfire, and erosion.** ▪ **Identifying key aquatic and terrestrial habitat vulnerable to adverse climate effects and expanding protected areas that provide amelioration of potential impacts.** ▪ **Assessments of public health, especially in vulnerable communities and populations; should include consideration of resilience to effects of climate change.** ▪ **Local general planning efforts that consider the effects of climate.** ▪ **Incorporating increased wildfire risk into agency planning.**
Climate Change Handbook for Regional Water Planning	Outline for assessing vulnerabilities and adaptation strategies.	The project team along with stakeholders identified vulnerabilities by using the Handbook's Appendix B, Vulnerability Assessment Checklist, as a primary resource, and subsequently used its direction to prioritize those vulnerabilities.

11.2 Current Climate Trends and Impacts

DWR has projected impacts for the western slope of the Sierra that include increases in temperature of 2.5°F over the next century, larger and more intense storms, decreased snowpack at lower elevations, earlier timing of spring runoff, increased evapotranspiration, changes in flora and fauna, and increased forest fire risk.[3] By 2020, projections indicate that water demand in California will exceed supply by more than 2.96 billion cubic meters.[4]

The California Emergency Management Agency and California's Natural Resource Agency's California Adaptation Planning Guide (2012) offers the following: "Climate change adaptation strategies [that] seek to reduce vulnerability to projected climate changes and increase the local capacity to adapt." The Guide breaks the state into regions based on biophysical characteristics and jurisdictional boundaries, and includes Yuba County in the Northern Central Valley Region (along with Butte, Colusa, Glenn, Madera, Sacramento, San Joaquin, Stanislaus, Sutter, Tehama, and Yolo Counties). It projects the following climate-related trends and impacts for the region.

Table 11-2. Summary of Cal-Adapt Climate Projections for Northern Central Valley

EFFECT	RANGES
Temperature Change, 1990-2100	**January increase in average temperature of 4°F to 6°F by 2050 and between 8°F and 12°F by 2100. July increase in average temperature of 6°F to 7°F by 2050 and 12°F by 2100. (Modeled high temperatures – average of all models; high carbon emission scenario.)**
Precipitation	**Annual precipitation is projected to decline by approximately 1 to 2 inches by 2050 and 3 to 6 inches by 2100. (CCSM3 climate model; high carbon emissions scenario.)**
Heat Wave	**Heat wave is defined as five days over 102°F to 105°F, except in the mountainous areas to the east. Two to three more heat waves per year are expected by 2050, with five to eight more by 2100.**
Wildfire Risk	**By 2085, the north and eastern portions of the region will experience an increase in wildfire risk, more than four times current levels in some areas. (GFDL model, high emissions scenario.)**

Source: California Emergency Management Agency and California Natural Resources Agency. *California Adaptation Planning Guide.* July 2012.

The following analysis takes a look at many of these projected climate-related impacts from a Yuba County region-specific point of view, but the bottom line is that most projections suggest an increasing variability from the historical climate record.

[3] Ibid.

[4] Mehta, V.K.; V.R. Haden; B.A. Joyce; D.R. Purkey; L.E. Jackson. Irrigation demand and supply, given projections of climate and land-use change, in Yolo County, California (2012). Agricultural Water Management. 117 (2013)70-82. Available from: www.elsevier.com/locate/agwat

Temperature

According to studies and analyses of weather and climate data by US Forest Service ecologists,[5] the western United States is the country's fastest-warming region. Mean annual temperatures in the Sierras, in general, have increased by around 1°F to 2.5°F over the last 75 to 100 years. However, some localized areas, potentially including some microclimates in Yuba County, have experienced slight cooling trends. Overall warming is due to slightly warmer nights, rather than daily maximum temperatures.

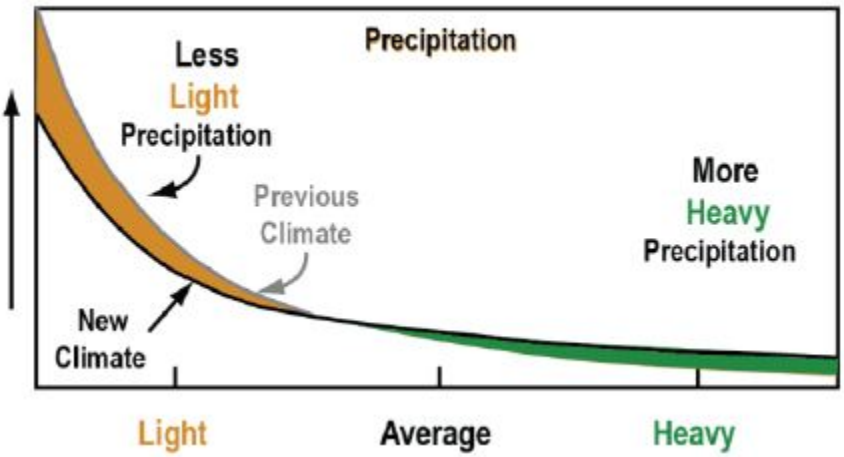
The Cal-Adapt Website[6] offers temperature projections for Marysville under low- and high-emissions GHG scenarios. Under the low-emissions scenario, Marysville average temperature is projected to rise from a historical average of 62.5°F to 66.3°F (+3.8°F), and to 69.1°F (+6.6°F) under the high-emissions scenario by 2080.

Elevation also plays a part in climate trends; there are fewer days with below-freezing temperatures at higher elevations, and more days of extreme heat at lower elevations in the Sierras.

Precipitation

Most of the west slope of the northern Sierras, including the Yuba County IRWM region, has experienced an increasing trend in precipitation between 1930 and 2000.[7] At the same time, increasing *variability* in annual precipitation is occurring year-to-year, with higher highs and lower lows totals. DWR predicts fewer total light rain events and more heavy events for Yuba County into the future.[8]

Figure 11-2. Increasing Variability in Annual Precipitation



Source: DWR Climate Change Handbook for Regional Water Planning (November 2011) pg. 36

[5] Safford, H.D., M. North and M.D. Meyer. Chapter 3: Climate Change and the Relevance of Historical Forest Conditions, Managing Sierra Nevada Forests. Albany, CA: US Department of Agriculture, Forest Service, Pacific Southwest Research Stations. No date. Available from: http://www.fs.fed.us/psw/publications/documents/psw_gtr237/psw_gtr237_023.pdf

[6] Cal-Adapt – Exploring California's Climate Change Research. (7/26/13). Available from: http://cal-adapt.org/ tools/factsheet/

[7] Ibid.

[8] US Environmental Protection Agency, CA Department of Water Resources, US Army Corps of Engineers, and the Resource Legacy Fund. Climate Change Handbook for Regional Water Planning (December 2011). Available from: http://www.water.ca.gov/climatechange/docs/Climate_Change_Handbook_Regional_Water_Planning.pdf

Even though regional precipitation may slightly increase on a near-term basis, greater variability in the climate regime has brought on increased chance for drought events. According to NOAA, the frequency with which a large percentage of California has experienced severe to extreme drought has risen significantly since 1980.[9] Agricultural disasters due to drought (declared by USDA) occurred in Yuba County in each of the years from 2001 through 2005.[10]

Runoff and Streamflow

Runoff in the Yuba County IRWM region is affected by timing and amount of precipitation, snowpack, and the effect of temperature on snowpack. The onset of spring thaw is occurring 5 to 30 days earlier in 2002 than in 1948 in the central Sierra Nevada, due mostly to higher temperatures. Peak streamflow is also occurring 5 to 15 days earlier (Stewart et al. 2005)[11] with a concomitant reduction in summer streamflows. DWR estimates that for each 1 degree C increase in Earth's temperature, the Sierra snowpack will retreat 500 feet, resulting in less available storage flows during April through July as compared to current conditions.[12]

In a 2012 study, PG&E examined possible side effects of climate change on runoff by comparing two consecutive 35-year periods (1942-1976 and 1977-2011).[13] The company maintains daily runoff records for 100+ locations in the Sierra, southern Cascade, and Coastal Ranges of California. This study showed that out of the 13 rivers studied, the Yuba River at Smartsville has experienced the third highest reduction in unimpaired runoff between these two periods (-3.4 percent), behind only the Klamath River at Orleans (-10.6 percent) and the Feather River at Oroville Dam (-4.5 percent).

When comparing the two 35-year periods, PG&E also found that the standard deviation in runoff on the Yuba River increased by 30 percent for the unimpaired water year during the second period. While it is fairly common for rivers flowing over exposed granite (such as the Yuba River) to have a large variance in flows, this increase in percentage is abnormal. Further, it was found that a large portion of the April through June runoff has shifted into the March and even February period, corroborating the studies mentioned above. By percentage shift in timing of runoff, the Yuba River is second only to the Feather River in this trend.

YCWA's Agricultural Water Management Plan documents decreased flow trends in the Feather River over the last 100 years and predicts that the Yuba River will likely experience similar effects, based on the proximity of the watersheds. It states that, "Projections suggest an average decrease in total water year runoff of approximately seven percent."

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[9] National Oceanic and Atmospheric Administration, Table: Percent Area of the California Basin Experiencing Severe to Extreme Drought, January 1895-March 2004 (Copyright 2004), National Drought Mitigation Center.

[10] Office of Emergency Services, Yuba County Multi-Jurisdictional Multi-Hazard Mitigation Plan, Yuba County, CA (2009). Available from: http://www.co.yuba.ca.us/departments/OES/PDM/Multi-hazard%20mitigation%20plan/Plan%20Documents/Section%204%20-%20Risk%20Assessment.pdf

[11] Stewart, I.T; Cayan, D.R.; Dettinger, M.D., Changes toward earlier streamflow timing across western North America. Journal of Climate. 18: 1136-1155 (2005).

[12] Starr Consulting, Palencia Consulting Engineers, and Talavera & Richardson. American River Watershed Survey. (December 2008).

[13] Freeman, G. J. Analyzing the Impact of Climate Change on Monthly River Flows in California's Sierra Nevada and Southern Cascade Mountain Ranges. Western Snow Conference 2012. (2012). Available from: http://www.westernsnowconference.org/sites/westernsnowconference.org/PDFs/2012Freeman.pdf

Flooding

The Yuba County Multi-Jurisdictional Multi-Hazard Mitigation Plan (2009) lists flooding (and attendant levee failure) as the "greatest natural disaster to the County." The Plan states that "Yuba County has a long history of catastrophic flooding events involving both the Yuba and Feather Rivers. Five major floods since 1950 have resulted in loss of life, significant property damage, and strained economic development in the area."

The California Adaptation Planning Guide (2012) states that the Central Valley will be subject to increased extreme high-flow events due to rapid snowmelt combined with more intense rainstorms. Peak natural flows have increased on many of the state's rivers during the past 50 years. For instance, the five highest floods of record on the American River have occurred since 1950.[14]

Storm Intensity

Three significant and damaging winter storm events have occurred in the last 20 years: in 1986, 1997, and 2005-2006. Rainfall accumulations of 20-24 inches in the most recent storm make that the fourth wettest December on record since 1920.[15] Overall, California is predicted to have more heavy storm events and less light rainfall, a phenomenon that also has implications for increased flood potential.

Groundwater

According to the YCWA Groundwater Management Plan (2010), groundwater levels along the Feather River in both the North and South Yuba subbasins have been generally stable since at least 1960.

Starting in the 1970s, the North subbasin (Ramirez Water District, Cordua Irrigation District, Hallwood Irrigation Company, and Browns Valley Irrigation District), began showing groundwater level improvements coinciding with surface water deliveries to the Ramirez Water District. Similarly, groundwater elevations recovered from historical overdraft in the central South Yuba subbasin (Brophy Water District, Dry Creek Mutual Water Company, South Yuba Water District, and Wheatland Water District) when surface water deliveries were made there, starting in the 1980s. Spring groundwater flows on average from about 140 feet above mean sea level (msl) in the east to 30 feet above msl in the west county. Total freshwater storage in Yuba County's groundwater basin is estimated to be 7.5 million acre-feet (maf). However, since most wells are screened at less than 300 feet below ground surface, readily accessible freshwater is estimated at 4.0 maf.

The greatest water demand by far (80 percent or more) is for agricultural use, primarily for crop irrigation. The Groundwater Management Plan suggests that runoff and recharge from irrigation may be a significant contributor to overall groundwater, offering over 30 percent of recharge from percolation of applied surface water. About 30 percent of the region's irrigation comes from groundwater pumping, the majority of which occurs south of the Yuba River. All five municipal purveyors (Marysville, Olivehurst, Linda, Wheatland, and Beale AFB) depend exclusively on groundwater for municipal and industrial water supply.

[14] California Department of Water Resources, Managing An Uncertain Future: Climate change adaptation strategies for California's water. Sacramento, CA, State of California (October 2008). Available from: http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf

[15] Office of Emergency Services, Yuba County Multi-Jurisdictional Multi-Hazard Mitigation Plan, Yuba County, CA (2009). Available from:http://www.co.yuba.ca.us/departments/OES/PDM/Multi-hazard%20mitigation%20plan/Plan%20Documents/Section%204%20-%20Risk%20Assessment.pdf

Groundwater substitution transfers have been completed in six relatively dry years since 1991; during such a year groundwater demand can double, and is then generally recharged within two to three years after pumping ends. Most recently, in 2009, during the second year of groundwater substitution transfers and the third year of a relatively dry cycle, irrigators in Reclamation District 10, located along the Feather River in the North Subbasin, experienced lower groundwater discharge rates from irrigation wells, lower than the previous six years. Reduced groundwater elevations were attributed to dry conditions, additional pumping within Reclamation District 10 due to dry conditions, and groundwater substitution transfer pumping outside of Reclamation District 10. Additional pumping-rate and groundwater level monitoring was initiated to assess and address this problem.

Wells in the region range from less than 300 feet in the east basin to about 700 feet in the west, with some well depths as much as 900 feet at the Feather River.

The above information applies generally to the valley floor and contrasts with the Sierra foothills where groundwater is highly unreliable because of fractured rock aquifers. For example, Camptonville depends on the vast majority of it water supply from groundwater, which is currently inadequate in drought years. The two existing wells have limited quantities of poor quality water.[16]

Water Quality

Surface water quality: Current water quality problems in the watershed include sediment and mercury deposition from past hydraulic mining; sediment from development, timber harvest, recreation, and road-building activity; temperature increases brought on by water storage and diversion, inadequate shading, and low flows; and impairment due to elevated levels of copper and zinc. Increases in air temperature and increased or prolonged drought could result in increased water temperatures, a reduced capacity for dilution, increased potential for eutrophication and total organic carbons related to increased algae presence, increased sediment and non-point source pollution from more intense storm events and higher peak flows, and increased wastewater runoff into receiving waters.

Groundwater quality: Valley groundwater quality data have been collected in the Yuba County IRWM region since 1965 in selected wells from both subbasins. In a 2008 survey, no wells less than 200 feet deep exceeded drinking water Maximum Contaminant Levels (MCL) in the North subbasin. In the South subbasin, one well less than 200 feet exceeded the MCL for nitrate. Wells greater than 200 feet deep commonly approach or exceed the MCL for total dissolved solids. Further, most areas in the region show increasing trends for Total Dissolved Solids (TDS) and alkalinity. Elevated levels of TDS are associated with deep groundwater pumping and can negatively impact irrigated agriculture and the taste of domestic drinking water.[17]

As mentioned above, Camptonville's two existing wells have poor quality water.

[16] Richard J. DicKard, Camptonville CSD, pers. comm. (February 20, 2014).
[17] Yuba County Water Agency, Yuba County Water Agency Groundwater Management Plan (December 2010).

Sea Level Rise

According to the 2030 General Plan Update EIR for Yuba County, even the upper range projections for sea-level rise (4.6 feet by 2099 [IPCC 2007]) would not directly affect Yuba County.

Regional Population Trends in the Climate Context

The county has experienced population growth in the recent past. According to the California Department of Finance, Yuba County's total population increased from 60,219 in 2000 to 72,155 in 2010, with 22 percent in incorporated areas and 78 percent in unincorporated areas. The county's projected growth rate through 2050 is the second highest in the state, after neighboring Sutter County. The California Department of Finance forecasts there will be 143,973 residents of Yuba County in 2050, representing a doubling of the 2010 estimated population.[18]

Of equal interest are demographic data for vulnerable populations, often under-represented in planning decisions. Just over 26 percent of the county population is Hispanic/Latino, and just over 7 percent is Asian. The Adaptation Guide indicates that Yuba County, at 20.7 percent of its population below poverty level, is third only to Merced County at 23.1 percent and Madera County at 21.7 percent for 12 counties in the Northern Central Valley region. Yuba County also exhibits a higher-than-average population of children under five. These disadvantaged segments of the community are often the least able to respond or adapt to the impacts of climate change.

Table 11-3. Selected Population Data for the North Central Valley Region and Yuba County

	Total 2010 Pop.	Pop. <5 yrs.	Percent <5 yrs.	Pop. ≥ 65 yrs.	Percent ≥ 65 yrs.	Estimated all ages	Avg. Est. percent	Margin of Error
North Central Valley	3,725,950	276,063	7.4%	414,921	11.1%	679,162	18.9	
Yuba County	**72,155**	**6,217**	**8.60%**	**7,255**	**10.10%**	**14,708**	**20.7**	**3.5**

Source: US Census Bureau, 2010. General Population and Housing Characteristics & Small Areas and Income and Poverty Estimates

11.2.1 Modeled and Simulated Projections

MC1 Vegetation Modeling

Modeling to analyze potential climate impacts on vegetation, conducted in 2013 for the CABY IRWM region that includes Yuba County, "showed an increase in and general upslope movement of the warm temperate/subtropical mixed forest (regional examples include Douglas Fir-Tanoak forest, Ponderosa Pine-Blackoak forest, and Tanoak-Madrone-Oak forest). This is largely displacing the boreal conifer forest, less tolerant of heat and drought. The temperate mixed xeromorphic woodland moved upslope from the foothills just outside of the western edge of the CABY region, further into the region (displacing the warm temperate/subtropical mixed forest upslope). The vegetation communities at the highest elevations in the region became more complex and varied, and generally drier, moving to temperate arid

[18] AECOM, Final Yuba County General Plan, Environmental Impact Report, Sacramento, CA (May 2011). Available from: http://www.yubavision.org/EIR.aspx

and/or Mediterranean shrubland, expanded xeromorphic woodland, and grasslands[19]. All future scenarios projected an increase in the number and severity of fires, but the change became more significant toward the end of the century (Lenihan, 2008)." See Chapter 19 *Technical Analysis and Data Management* for further discussion of the methodology used for MC1 modeling.

11.3 Climate Vulnerabilities

The 2030 General Plan Update EIR for Yuba County states that "Climate change is expected to result in a variety of effects that could potentially impact Yuba County: alternations to agricultural production; changes to terrestrial and aquatic ecosystems; increased energy demand; decreased water supply; increased risk of flooding; and increased frequency and intensity of wildfire. Substantial negative effects on residents, resources, structures, and the economy could result. This impact would be potentially significant."

More specifically, the EIR lists potential vulnerabilities identified during Yuba County's General Plan development process:

- reduced agricultural production as a result of changing temperatures and precipitation patterns;
- changes in composition, health, and distribution [displacement] of terrestrial and aquatic ecosystems, particularly associated with increased saltwater intrusion into the Sacramento-San Joaquin River Delta;
- reduced hydro-electric energy production caused by changes in the timing and volume of runoff;
- increase in vector-borne diseases;
- increased energy demand associated with increased temperatures;
- water supply conflict; and
- increased risk of flooding and wildfire associated with changes to precipitation patterns.

The Adaptation Guide suggests that in the Northern Central Valley, communities should assess the effects of the following:

- temperature increases;
- reduced precipitation;
- flooding – increased flows, snowmelt, levee failure;
- reduced agricultural productivity;
- wildfire in the Sierra foothills;
- public health and heat; and
- reduced tourism.

In the following section, these impacts and the vulnerabilities they suggest are examined in closer detail to determine where the region may have the most exposure to impacts from climate change. **Table 11-4** displays a list of anticipated vulnerabilities.

[19] Perennial grasses can be classified as either C3 or C4 plants. These terms refer to the different pathways that plants use to capture carbon dioxide during photosynthesis. These differences are important because the two pathways are also associated with different growth requirements: C3 plants are adapted to cool season establishment and growth in either wet or dry environments, and C4 plants are more adapted to warm or hot seasonal conditions under moist or dry environments. C3 species also tend to generate less bulk than C4 species, but the C3 feed quality is often higher.

Table 11-4. Climate Vulnerabilities and Strategies to Increase Climate Resiliency			
Summary of Information	**Identified Vulnerabilities**	**Existing Adaptive Strategies**	**Potential Future Strategies/Proposed Projects[1]**
Water Supply/Demand	▪ Camptonville and other foothill communities/ rural areas currently suffer water shortages ▪ Camptonville's summer user demand and Title 22 requirements exceed the capacities of the water treatment system ▪ Reduced water supply reliability ▪ Agriculture water use may be the most vulnerable to climate change ▪ Environmental flows also will likely be affected by increasing temperatures, erratic rainfall, and earlier snowmelt ▪ Reservoir storage levels decline for the summer months and some lack carryover capacity (>2 yrs.) ▪ Declining snowpack increases the risk of supply uncertainty ▪ Changes will be required for basin-wide management and storage of water, especially for irrigation ▪ Groundwater extraction in reaction to climate change has the potential to affect wetland-dependent, riparian, and aquatic habitats ▪ State water policies and out-of-region demands (e.g., Delta) could affect water supply as much as the impacts from climate change ▪ Increased frequency of water transfers within the context of a finite water supply ▪ Ability to deliver water transfers may be jeopardized ▪ Out-of-region diversions may decrease ▪ State water policies and out-of-region demands (e.g., Sacramento-San Joaquin Delta) could affect water supply management as much as the direct effects of climate change	▪ Implement laser-leveling of fields, refrain from draining rice fields before cultivation ("stop irrigation"), sprinkle, and micro-irrigate orchards ▪ Line/pipe canals as in the Brophy Water District, Browns Valley Irrigation District, and Hallwood Irrigation Company ▪ Implement Basin Management Objectives as outlined in YCWA's Groundwater Management Plan ▪ Conduct conjunctive use of surface and groundwater, water transfers (artificial recharge), wastewater recycling, and irrigation water re-use ▪ Improve public understanding of water resources and need for conservation ▪ YCWA is employing locally cost-effective Efficient Water Management Practices identified by SBX7-7 to achieve water use efficiency improvements of irrigation facilities ▪ Groundwater monitoring is currently being conducted by YCWA under its groundwater monitoring plan ▪ YCWA's Groundwater Adaptive Management Tool helps model groundwater response and recovery throughout the Yuba basin ▪ Conjunctive use of surface and groundwater, water transfers (artificial recharge), wastewater recycling, and irrigation water re-use	▪ Additional storage projects, such as possible projects at Dry Creek and New York Flat ▪ New Bullards Bar mid-release outlet to allow for more flexible water management, especially during flooding ▪ Additional canal/ditch lining ▪ Additional drip irrigation ▪ Municipal water recycling ▪ Incentivize on-farm water conservation ▪ Dredge Englebright Lake to increase storage ▪ Increased groundwater monitoring to assure sustainable groundwater management ▪ Implement a network of shallow monitoring wells to detect the rate of, and cumulative change over the year of groundwater levels, the shallowest portion of the aquifer ▪ Increase ability to re-use tailwater runoff ▪ Evaluate the existing water resource requirements of native habitat ▪ Incentivize on-farm water conservation to decrease demand ▪ Increased groundwater monitoring to assure sustainable groundwater management

Summary of Information	Identified Vulnerabilities	Existing Adaptive Strategies	Potential Future Strategies/ Proposed Projects[1]
Water Supply/Demand *(continued)*	▪ Climate change-related surface water decreases could increase future groundwater demands and out-of-area transfer demands ▪ Urbanization; changes in technology; and timing of crop planting, development, and harvest could result in altered timing and demand for irrigation water ▪ Conflicts may increase among agricultural, domestic, flood control, hydrogeneration, and environmental water management ▪ Further data is needed to fully manage the region's groundwater	▪ YCWA and management units have increased recycling and re-use of municipal and industrial water discharge from Beale AFB, the City of Wheatland, and Olivehurst PUD ▪ YCWA continues to seek funding for addressing groundwater data gaps	▪ Local agency and public involvement in state policy and regulatory processes ▪ Consider crop idling as long as it does not facilitate out-of-region transfers; check resource management strategies ▪ Consider providing/expanding fee incentives for municipal and agricultural customers who meet conservation objectives (tiered pricing)
Water Quality	▪ Camptonville's water quality suffers during heavy rain events, requiring the treatment plant to be shut down due to turbidity ▪ Increased algae could reduce delivery capacity and increase the need for filtering of irrigation infrastructure in localized areas ▪ Peak storm events may increase transport of mercury from stream channels, with related potential for increased methylmercury ▪ Decreased overall supply would likely result in a higher concentration of pollutants ▪ Increased water temperatures may significantly impact aquatic ecosystems ▪ Fluctuating reservoir water levels due to increased climate variability could result in increased sedimentation and reservoir storage and maintenance problems ▪ Removal of vegetation from increased wildfire could result in increased erosion and sedimentation	▪ Water quality monitoring is currently being conducted by YCWA under its groundwater management plan ▪ YCWA coordinates with the Yuba County Agricultural Commissioner's office as part of the Sacramento Valley Water Quality Commission and to coordinate with the Irrigated Lands Regulatory Program	▪ Dredge Englebright Lake and/or above Daguerre Point Dam to remove toxic sediments (mercury) ▪ Conduct headwater meadow and forest restoration ▪ Additional monitoring is needed to fully understand groundwater quality

Summary of Information	Identified Vulnerabilities	Existing Adaptive Strategies	Potential Future Strategies/ Proposed Projects[1]
Infrastructure (water storage and conveyance)	▪ Water storage infrastructure was designed for a historic demand, and may not accommodate increased winter peak flows, or have adequate carryover storage for drought periods ▪ The conveyance system was designed for a certain demand; therefore, inadequate peaking capacity may exist during times of extraordinary heat (for irrigation demand) ▪ Conflicts over storage may increase among agricultural, domestic, hydropower, flood control, and environmental needs		▪ Additional storage projects, such as possible projects at Dry Creek and New York Flat ▪ New Bullards Bar mid-release outlet to allow for more flexible water management, especially during flooding ▪ Additional canal/ditch lining
Flooding	▪ Increased storm intensity and severity puts communities, critical infrastructure, and protective levees at greater risk ▪ Responses to increased flood risk could impact water delivery for regional demands and hinder YCWA's ability to transfer stored water ▪ Flooding infrastructure was designed for historic flood regimes and to protect substantially less human development, and may increase conflicts/complexity in managing for both storage and flood control	▪ Upgrade agricultural and municipal levees (City of Wheatland working on this goal) ▪ The Bear River and Feather River setback levees	▪ Install a New Bullards Bar mid-level outlet ▪ Petition for refinement of New Bullards Bar flood-operating rules to better capture earlier springtime snowmelt ▪ Upgrade additional levees and provide greater setbacks for levees ▪ Headwater meadow and forest restoration ▪ If necessary, work with US Army Corps of Engineers to modify flood control operations
Species and Habitat	▪ Vegetative communities are expected to move upslope with significant loss of subalpine and alpine vegetation and large increases in hardwoods and grasslands ▪ Climate variation is projected to affect foothill woodland and chaparral vegetation and the rare and unique species they support ▪ Decreases in surface flows may threaten fish and other aquatic life	▪ Tahoe National Forest will complete a climate vulnerability assessment in 2014 to prioritize areas most in need of restoration ▪ Plumas National Forest is focusing current forest activities on resilience of general forested landscapes to stand-replacing wildfire, particularly in high-value wildlife habitat ▪ PNF's forest health restoration focus is on fuels reduction work that reduces fire risk to communities, strategic watersheds, and	▪ Manage for ecosystem structure, heterogeneity, and process rather than for specific species or their habitat ▪ Set-back levees to allow for habitat re-colonization of floodplains ▪ Conduct headwater meadow restoration ▪ Create off-channel salmon habitat ▪ Dam Removal (Daguerre Point)

Summary of Information	Identified Vulnerabilities	Existing Adaptive Strategies	Potential Future Strategies/ Proposed Projects[1]
Species and Habitat *(continued)*	▪ Increased fire frequency and intensity may impact vegetative species composition, especially the size and extent of old-growth forest habitat and related fauna ▪ Water demands may jeopardize mandated environmental flows for aquatic species ▪ Significant changes in bird distribution and composition (especially wetland-dependent species), and substantial impacts to amphibians are anticipated ▪ Saltwater intrusion from sea-level rise may displace fauna from Sacramento Delta to refugia in the Yuba County IRWM region ▪ Future regional climate may favor certain invasive species, decreasing viability for native and desired species ▪ Increased demand on groundwater may desiccate groundwater-dependent ecosystems	recreation sites, and watershed work that improves connectivity and restores meadows and riparian/aquatic ecosystems ▪ Implement the Yuba Accord to help maintain in-stream flows ▪ Both TNF and PNF are incorporating invasives management into forest health management and restoration projects ▪ The Nature Conservancy is paying farmers to seasonally flood fields for critical wetland-dependent bird habitat in the Central Valley	▪ Restore specific wet meadow and/or spring habitats identified by stakeholders on private lands to improve shallow groundwater storage, increase summer base flows, improve in-stream habitat diversity ▪ Participate in large-scale planning to promote habitat connectivity, consider human-assisted dispersal of species, and prioritize refugia for conservation and restoration ▪ Consider a role to help mitigate impacts from out-of-area sea-level rise through water transfers or other means ▪ Create off-stream salmon habitat via floodplain expansion from levee setback ▪ Evaluate the existing water resource requirements of native habitat

Summary of Information	Identified Vulnerabilities	Existing Adaptive Strategies	Potential Future Strategies/ Proposed Projects[1]
Socioeconomics	**Public Health and Safety** ▪ Increased potential for flood risk could result in human and economic losses ▪ Flooding and heat waves may have the greatest effects on disadvantaged/under-represented communities ▪ The northern two-thirds of the county's critical facilities are exposed to fire threat hazard ▪ Residential development is taking place in fire-adapted vegetation, increasing potential for human and economic loss ▪ Increased fire-threat hazards will increase fire management costs	▪ Partner with public health community outreach to prepare under-represented and DACs for flooding, wildfire, and heat-wave events ▪ Provide bilingual climate vulnerability outreach for Hispanic residents	▪ Install a New Bullards Bar mid-level outlet ▪ Upgrade levees ▪ Conduct headwater meadow restoration ▪ Site critical public facilities out of fire-prone areas ▪ Create fire-safe zones around critical facilities ▪ Provide more public education in fire-prone areas for local residents
	Agriculture ▪ Greater evapotranspiration may lead to conditions less suitable for traditional crop types ▪ Heat-sensitive crops and livestock likely will be vulnerable to prolonged high temperatures ▪ Lost revenues from climate-related events will potentially negatively affect regional income, employment, and tax revenues ▪ Water deficits could hasten conversion of agricultural land to urban uses	▪ Upgrade municipal and agricultural levees to 100-year resilience ▪ Employ agricultural water conservation measures suggested above ▪ Implement the Yuba Accord and employ forest restoration action mentioned above ▪ Plumas National Forest is improving the economics of forest product removal and capitalizing on opportunities for partnerships, particularly to leverage declining appropriated dollars ▪ Plumas National Forest is completing a Strategy for Sustainable Recreation to integrate recreation projects with forest health restoration projects ▪ Work with county agricultural groups to publicize Yolo County's agricultural climate adaption website, prepared in collaboration with U.C. Davis (http://agadapt.ucdavis.edu/)	▪ Anticipate and plan for a shift in crops/crop patterns, or crop mixes ▪ Fuel treatments would provide employment opportunities for the regional economy while decreasing future wildfire related expenses

Summary of Information	Identified Vulnerabilities	Existing Adaptive Strategies	Potential Future Strategies/ Proposed Projects[1]
Socioeconomics *(continued)*	**Hydropower Production** ▪ Climate impacts on high-elevation hydropower production would have wide-ranging effects ▪ Climate adaptation will likely require a combination of operating changes to hydro-generation facilities, with related secondary impacts to water facilities and delivery; even so, generation losses are probable ▪ Revenue losses from hydropower are projected. Decreased hydropower production coupled with increased summer energy demands could affect the local economy **Recreation** ▪ Recreational pursuits and tourism could be affected by low flows ▪ Projected low flows may not be sufficient to sustain FERC-licensed rafting flows, having secondary negative effects on the local economy ▪ Recreational forest resources are likely to be affected by changes in flow regime **Timber Harvest** ▪ Potential climatic changes are expected to affect type, location, and amount of timber inventories, but may generate need for alternative timber management/production and fuels reduction project		▪ Hydrogeneration managers may increase storage in the winter in anticipation of critical summer needs and to provide flexibility in management options ▪ Explore environmentally acceptable and economically feasible ways of producing and using power from biomass ▪ Create value-added markets for forest biomass, including local biomass power generation

[1] Many of these adaptation strategies will need to be further refined. Future WEAP modeling and analyses will help provide better direction for designing successful strategies.

11.3.1 Projected and Anticipated Vulnerabilities

Water Supply

- **Reduced water supply reliability.** YCWA's flexibility in supplying water is constrained by amount and timing of runoff, available storage, minimum in-stream flow requirements, flood control operational requirements, and power purchase agreements with PG&E. Reduced total inflows and less certain timing of flow into Yuba River reservoirs in the future from climate variability would increase the probability that agricultural, environmental, and other demands might not be met.[20]
- **Declining snowpack increases the risk of supply uncertainty**. Snowpack that does occur is expected to melt earlier in the spring, leaving a longer period of time between the period of bulk spring runoff and summer agricultural irrigation demands for water. An increasing risk of supply uncertainty is expected to result.
- **Agricultural water use may be the most vulnerable to climate change**. Modeled data indicate that agricultural water use may be the most vulnerable to climate change as urban users' willingness to pay for water outstrips agricultural water users' ability to pay.[21] Further, agriculture is the only identified industry requiring cooling and process water in the county. This industry could be impacted by rising utility costs from additional air-conditioning due to rising temperatures, and eventually by higher power costs if hydropower generation is impacted as projected.
- **Reservoir storage levels decline for the summer months.** Reservoir storage levels are projected to peak earlier in the year and decline for the summer months.[22] Freeman (2003) states that "system-wide dams were built under a historical flow regime that depended on 1) 25% of precipitation from snowfall, 2) 37% from snowmelt, and 3) 38% from groundwater (primarily springs). Changes from the historic norm have the potential to change spill frequency and magnitude compared with historical data and design of the system."[23]
- **Changes will be required for basin-wide management and storage of water, especially for irrigation.** Management of basin-wide storage and conveyance operations will have to adapt to changes in precipitation and snowpack, and must have the capacity to capture the bulk of spring snowmelt earlier in the year and store it for a longer period of time until irrigation begins. This may become difficult given current reservoir capacity and operations within the basin. By way of example, in the Browns Valley Irrigation District subregion, Browns Valley Reservoir, and other area reservoirs don't have sufficient capacity to carry over surpluses (less than a two-year capacity). Further, conflicts between water users will likely increase, especially under the likelihood of increased drought conditions.

Water Demand

- **Camptonville and other rural foothill areas currently suffer water shortages.** Though small in comparison to Central Valley agricultural demands, Camptonville's water demand varies by more than 50 percent during the summer as compared to the winter. Camptonville has faced water

[20] Yuba County Water Agency, Agricultural Water Management Plan, Final (December 2012).
[21] California Climate Change Center, Water management adaptation with climate change. Prepared by: Azuara, J.M.; Connell, C.R.; Madani, K.; Lund, J.R.; and Howitt, R.E. (Final paper August 2009).
[22] Ibid.
[23] Freeman, G. J. Climate change and California's diminishing low elevation snowpack - a hydroelectric scheduling perspective. Western Snow Conference 71:39-47 (2003). Available from: http://www.westernsnowconference.org/proceedings/pdf_Proceedings/2003%20WEB/Freeman,%20G._Climate%20Change%20and%20CA's%20Diminishing%20Low-Elevatio.pdf

shortages during drought conditions; water rationing has been required in the past. The Oregon House and Dobbins areas have also experienced well depletion during drought periods.

- **Increased frequency of groundwater transfers within the context of a finite water supply.** YCWA has water delivery obligations under the: 1) Sacramento Valley Water Management Program Short-term Settlement Agreement (to help meet water quality standards in the Sacramento-San Joaquin Delta, as set forth by the 1994 Delta Accord; 2) Yuba Accord, (to enhance Lower Yuba River fisheries, employ conjunctive use for regional water district needs, and conduct long-term transfer of enhanced Lower Yuba River flows); and 3) YCWA Transfer Program (aimed at supplemental water transfers in dry years to supply additional agricultural and urban uses). An analysis by the Water Environment Federation[24] suggested that due to urban growth and development and other uses, the groundwater transfer program "may be exercised with greater frequency and/or larger quantities." Warming and drying of the climate will likely contribute to the increased frequency of transfers and to overall limitations on a finite water supply.
- **Ability to deliver water transfers may be jeopardized.** Even if annual totals in precipitation remain relatively constant in the near future, as many climate models suggest, the frequency and magnitude of rain events are predicted to vary dramatically from previous decades. Large floods, long droughts, and a higher number of both very wet and very dry years are expected in the region. This too raises concerns regarding the ability to reliably store and deliver water for downstream users within the basin. These problems may be compounded by the fact that if rainfall occurs during fewer but larger storms and less snowpack is on the ground, groundwater basins may not be fully replenished each year (an especially problematic issue if substitution transfers are expected to increase during future dry years).
- **Out-of-region diversions may decrease.** Currently diversions southward to the Bear/American basin complex amount to an average of ~17 percent of total Yuba basin flows in a given year, via the Drum/Spalding diversion project. Recent studies demonstrated that were temperatures to increase, decreasing snowpack and altering the shape of the annual hydrograph, exports out of the Yuba basin would likely decrease to maintain compliance with in-stream flow requirements within the Yuba basin. This decreasing export trend would be even more accentuated were in-stream flow requirements to become more stringent in the future.
- **State water policies and out-of-region demands could affect water supply management as much as the direct effects of climate change.** The Yuba County IRWM region is partially within the Sierra Nevada, a source for the majority of the state's fresh water. As such, its water is under complex management by multiple agencies, and of considerable and competing value to out-of-region interests. Some regional stakeholders maintain that policies adopted by state agencies beyond the purview of the region (e.g., to address Sacramento Delta supply and ecological concerns in response to climate change, FERC relicensing for hydro power) could have as much effect on the region's water supply and management as direct climate impacts. By way of example, with continuing studies and concerns regarding declines of the native aquatic habitat putting higher pressure on managing water quality and quantity sustainably, there may be more pressure placed upon the Yuba basin to allow more of its surface water to flow south via the Feather and Sacramento Rivers, although the timing of these outflow demands are not certain. In dry years, there are often severe shortages in the Delta due to low inflows and high pumping export demands from southern California water contractors.
- **Climate change-related surface water decreases could increase future groundwater demands and out-of-area transfer demands.** US Department of the Interior, Bureau of Reclamation's

[24] Water Environment Federation, Groundwater management program for Yuba County Water Agency: a conjunctive use pilot project. Prepared by: Onsoy, Yuksel S.; Bonds, C.L.; Petersen, C.E.; Aikens, C.; and Burke, S.M.

SECURE Water Act 9503(c) fact sheet states that climate change-related surface water decreases in the Sacramento-San Joaquin drainages are "likely to significantly increase future groundwater demands."[25] Moreover, in dry years, water contractors south of the Bay-Delta (and the Bay-Delta itself) will likely experience severe shortages, in turn increasing the market-demand for transfer of Yuba water southward, often in the form of groundwater substitution transfers. This will have impacts upon the types of water and land-use practices within the Yuba basin (e.g., changing crop types, increased pumping), which is relatively "water-rich" in comparison to much of the state.

- **Urbanization, changes in technology, and timing of crop planting development and harvest could result in altered timing and demand for irrigation water.** Modeling conducted by the California Climate Change Center projects a 22.2 percent increase in urbanized land in Northern California, with a corollary decrease in agricultural land of -3.3 percent by 2050. In the same study, water demand is expected to drop by 2050, mostly due to increasing urbanization, but also to changes in technology, a warming climate, and crop demand related to income projections.[26] Changes in timing of crop planting, development, and harvest could result in altered timing for irrigation demands.
- **While YCWA is carrying out a Measurement and Monitoring Program, need exists for further monitoring and groundwater data to address the gap in knowledge necessary to fully and efficiently manage this resource. Further data is needed to fully manage the region's groundwater.** Conservation interests have identified potential habitat impacts associated with potential changes in water management practices in response to climate change, especially on shallow groundwater resources.

Water Quality

- **Increased algae could reduce delivery capacity and increase the need for filtering of irrigation infrastructure in localized areas.** Increased algae could result in additional challenges to YCWA and member agencies in controlling aquatic plants in distribution systems that could, in turn, reduce delivery capacity. Increased turbidity and algae growth could increase the need to filter surface water for micro-irrigation of orchard crops.[27]
- **Peak storm events may increase transport of mercury from stream channels, with related potential for increased methylmercury.** Peak storm events exacerbated by climate change could transport mercury from stream channels, which in turn could be converted to methylmercury. The methylation of mercury makes the pollutant "bio-available" and, if consumed, a neurotoxin. Methylmercury readily accumulates in organisms and concentrates in fish and wildlife at the top of the food chain. Documented consequences of methylmercury pollution and consequent dietary exposure include: 1) direct adverse effects on the health of fish, wildlife, and humans; 2) contamination of fishery resources that diminishes their nutritional, cultural, socioeconomic, and recreational benefits; and 3) socio-cultural damage to indigenous peoples who fish for subsistence.
- **Decreased overall supply would likely result in a higher concentration of pollutants.** Increased concentrations of pollutants may occur from increased groundwater pumping for agriculture and/or municipalities. Local pollution from landfills may impact neighboring surface and/or groundwater quality, especially when combined with other agricultural pollutants such as nitrate and various pesticides. Pollutants may be concentrated in surface water from a combination of

[25] SECURE Water Act 950(c) – Reclamation Climate Change and Water 2011, Section 7 – Basin Report: Sacramento and San Joaquin. Available from: www.usbr.gov/climate

[26] California Climate Change Center, Water management adaptation with climate change, Prepared by: Azuara, J.M.; Connell, C.R.; Madani, K.; Lund, J.R.; and Howitt, R.E. (Final paper August 2009).

[27] Yuba County Water Agency, Agricultural Water Management Plan, Final (December 2012).

lower flows and return flows from irrigation. Salinity concentrations may also begin to pose increasing threats to arable land in the face of a changing climate, irrigation practices, or water supply regime.

- **Sedimentation could result from reservoir bank erosion and wildfire.** The anticipated increase in drought duration/intensity will increase the extent of dewatered reservoir banks and removal of vegetation due to wildfire. Subsequently, the projected increase in extreme precipitation events will likely increase the erosion of reservoir banks and upstream riparia. This could lead to increased erosion and sedimentation, and subsequent reservoir storage and maintenance problems, along with attendant management costs.
- **Camptonville water quality compromised during heavy rain events.** Camptonville's water quality suffers during heavy rain events, requiring that the treatment plant be shut down due to turbidity in the surface water source.

Flooding

- **Increased storm intensity and severity puts communities, critical infrastructure, and protective levees at greater risk.** According to the Yuba County Multi-Hazard Plan, roughly one-third of the county's population lives in the 500-year floodplain, along with emergency evacuation routes, sewer and water treatment plants and other infrastructure, and numerous critical community facilities. Floods in 1986 and 1997, exacerbated by levee failures on the Yuba and Feather Rivers, inundated large areas south of Marysville in the Linda and Olivehurst communities. Levees are instrumental in protecting vulnerable populations in Marysville, Wheatland, and an area of Reclamation District 10 as well. At higher elevations, damage to roadways occurred from landslides and debris flows. Increased storm intensity and severity brought on by climate variation could exacerbate the types of impacts discussed above.

  The California Adaptation Guide suggests that communities should evaluate areas where increased flood height would potentially threaten structures, infrastructure, agricultural fields, and public safety.
- **Responses to increased flood risk could impact water delivery for regional demands and hinder YCWA's ability to transfer stored water.** Potential responses to increased flooding, such as increasing reservoir capacity and modification of flood control operations could result in earlier spilling and potentially less available irrigation water and environmental demands, and hinder YCWA's ability to transfer stored water.

Infrastructure (water storage and conveyance)

Water infrastructure may be inadequate under greater climate variability. Water storage infrastructure was designed for historic flow regime and development levels, and may not accommodate increased winter peak flows, or have adequate carryover storage for drought periods. The conveyance system was designed for a certain demand, and inadequate peaking capacity may exist during times of extraordinary heat (for irrigation demand). Conflicts over storage may increase among agricultural, domestic, hydropower, flood control, and environmental needs.

Wildfire

- **Fire risk is projected to rise significantly at higher elevations.** The Cal-Adapt website facilitates projections for fire risk based on climate modeling under high and low GHG emission scenarios for specific areas in California. However, it does not account for localized fuel loads or atmospheric

changes. All things being equal, it currently projects that fire risk will rise by about 200 percent in the Smartsville area and by about 300 percent in the Camptonville area by 2085.

- **Local conditions exacerbate future fire risks for Yuba County.** Highly flammable fuels, long dry summers, some management practices (e.g., conversion of some forest stands to even-aged plantations), and steep slopes and canyons, especially when combined with projected warming and drying of the climate, pose significant fire risks for Yuba County in the future. The Yuba County Multi-Hazards Mitigation Plan (2009) suggests that from May to October each year, two-thirds of the county faces a serious threat from wildfires, and local stakeholders report fire occurrences in every month of 2013, as well as a general extension of the fire season.[28] Research has identified high fire hazards in even-aged silvicultural systems (clear-cut conifer plantations) such as those located north and east of New Bullards Bar Reservoir.[29]

Species and Habitat

- **Groundwater extraction combined with a drying climate has the potential to impact water-dependent habitat.** The long-term health of riparian vegetation, wetlands (in particular, for wetland-dependent bird species in the Delta), and a number of other native habitats are commonly associated with a minimum range of groundwater levels and an appropriate level of interaction between surface and groundwater. Reduced groundwater levels due to climatic changes coupled with the potential need for increased groundwater extraction under a drying climate have the potential to impact the native habitat areas.
- **Vegetative communities are expected to move upslope with significant loss of subalpine and alpine vegetation and large increases in hardwoods and grasslands.** The highest resolution vegetation modeling to date is the MC-1 model used by Lenihan et al. (2003, 2008) to project climate impacts on Sierra west slope vegetation. All GHG emission scenarios project that vegetative communities will move upslope, with significant loss of subalpine and alpine vegetation, and most project lower cover of shrubland, including westside chaparral (resulting mostly from increased frequency and extent of fire). Large increases in hardwoods are projected, except under the most extreme hot-dry scenario in the foothills. Grasslands are expected to expand.[30]
- **Climate variation is projected to affect foothill woodland and chaparral vegetation and the rare and unique species they support.** Foothill woodland and chaparral vegetation communities are most frequently documented to contain rare and unique species, yet are experiencing fragmentation and damage from agricultural practices and development.[31] Climate variation may further stress these communities, or it may influence their shift to higher elevations.
- **Increased fire frequency and intensity may impact vegetative species composition, especially the size and extent of old-growth forest habitat and related fauna.** Increased frequencies and intensities of fires in coniferous forests are expected to drive changes in vegetative species

[28] Core Group meeting, January 16, 2014.

[29] Stephens, Scott L. and J. J. Moghaddas, Silvicultural and reserve impacts on potential fire behavior and forest conservation: Twenty-five years of experience from Sierra Nevada mixed conifer forests, Division of Ecosystem Science, Department of Environmental Science, Policy and Management, 137 Mulford Hall, U.C. Berkeley (February 2005). Available from: www.sciencedirect.com

[30] Lenihan, J.M.; Bachelet, D.; Neilson, R.P.; Drapek, R., Response of vegetation distribution, ecosystem productivity, and fire to climate change scenarios for California. Climate Change. 87(Suppl.): S215-S230, (2008).

[31] Sacramento River Watershed Program/Yuba River Watershed. Available from: www.sacriver.org/aboutwatershed/roadmap/watersheds/american/yuba-river-watershed

composition, and in turn, reduce the size and extent of old-growth forest habitat and the fauna it supports.[32]

- **Decreases in surface flows may threaten fish and other aquatic life.** Low flows and high temperatures in the South and Middle Fork Yuba Rivers, along with sediment from the legacy of mining, already compromise habitat for aquatic life. While the Lower Yuba River Accord attempts to safeguard populations of threatened fish species below Englebright Dam (green sturgeon, Chinook salmon, steelhead trout) by means of implementing legally binding in-stream flow requirements, warming water temperatures and highly variable hydrology within the basin will further stress these delicate populations despite such protective measures.
- **Water demands may jeopardize mandated environmental flows for aquatic species.** Without substantive water conservation and technological advances in water efficiencies, and careful operation of water delivery, water demands may outstrip regional supplies into the future, jeopardizing mandated environmental flows (such as under the Yuba Accord) for aquatic species.
- **Significant changes in bird distribution and composition, and substantial impacts to amphibians are anticipated.** Safford et al. suggest that substantive changes in regional species composition and distribution are already taking place and are expected to accelerate over the next century. Current and future species distribution models for 60 focal bird species in California found that avian assemblages would dramatically shift, as would patterns of species interactions. The Avian Data Center projects that about 60 percent of coniferous forest bird species in the Sierra will exhibit substantial range reductions within the next 40 to 90 years. Similarly, high vulnerability is projected for California's amphibians,[33] with lesser effects on mammalian fauna.
- **Salt-water intrusion from sea-level rise may displace fauna from Sacramento Delta to refugia in the Yuba County IRWM region.** While sea-level rise is not expected to directly affect the region, salt-water intrusion from sea-level rise may displace fauna from the Sacramento Delta that may seek refuge in the region.
- **Future regional climate may favor certain invasive species, decreasing viability for native and desired species.** Future regional climate is likely to favor certain invasive species. Additional invasive species act as stressors on native species that, when combined with greater climate variability and its impacts (such as increased fire risk), can cause decreased viability for native and desired species.

Socioeconomics

Public Health and Safety

- **Increased potential for flood risk could result in human and economic losses.** The cost of flood/levee failure is estimated at over $487 million for a 100-year event and at over $648 million for a 500-year event. Over 4 percent of all jurisdictional critical facilities are located in the 100-year floodplain in Yuba County, while 14 percent of such facilities are exposed to 500-year events. About 15,000 people were located in the 100-year floodplain in 2000, and of these, 2,300, or 15 percent were severely disadvantaged (annual incomes under $10,000). Increased potential for flood risk due to intense storm events and higher peak flows could result in loss of life, damage to critical facilities, property damage, and loss of business and tax receipts.[34]

[32] Lenihan, J.M.; Bachelet, D.; Neilson, R.P.; Drapek, R., Response of vegetation distribution, ecosystem productivity, and fire to climate change scenarios for California, Climate Change, 87(Suppl.): S215-S230, (2008).

[33] Yarnell, Sarah M., J. H. Viers, and J. F. Mount. Ecology and Management of the Spring Snowmelt Recession. Bioscience, Vol. 60, No. 2, (February 2010). Available from: https://watershed.ucdavis.edu/pdf/Yarnell_etal_BioScience2010.pdf

[34] Ibid.

- **Flooding may have the greatest effects on disadvantaged/under-represented communities.** The elderly and the young, and populations that lack resources or knowledge due to language or economic status are potentially the most vulnerable to the effects of flooding; adaptation strategies may require coordination with public health officials.
- **Increased potential for heat waves may disproportionately affect under-represented communities.** The elderly and the young, and populations that lack resources or knowledge due to language or economic status are potentially the most vulnerable to the effects of heat waves; adaptation strategies may require coordination with public health officials.
- **Heat-sensitive crops and livestock will be vulnerable to prolonged high temperatures.** Rice is projected to experience only a moderate loss (<10 percent), while nut trees may suffer from a lack of nighttime cooling. Each crop will react differently and specific production losses are difficult to project because they are subject to factors additional to temperature, such as precipitation, pests, and management. The severity of heat stress can also affect the level of milk production in dairy cattle.[35]
- **The northern two-thirds of the county's critical facilities are exposed to fire-threat hazard.** According to California Division of Forestry data, the northern two-thirds of the county's critical facilities are exposed to fire-threat hazard, and several are in the "Very High Fire Hazard Severity Zone," including YCWA's Colgate Power House and Narrows #2 Power House.
- **Residential development is taking place in fire-adapted vegetation, increasing potential for human and economic loss.** Many existing and new homes are built in fire-adapted vegetation types, such as oak woodlands (with two- to eight-year fire return intervals) and remaining forest types with five- to sixteen-year fire return intervals. Recent fires include the 1997 Dobbins-Oregon House fire that destroyed 417 structures and numerous vehicles valued at $20 million. The 1999 Pendola fire covered nearly 12,000 acres and caused $3 million in damages.[36]

Agriculture

- **Greater evapotranspiration may lead to conditions less suitable for traditional crop types.** If other atmospheric conditions remain similar to the present (such as humidity levels), temperature rise will lead to greater evapotranspiration, which in turn could lead to greater water demand and conditions less suitable for traditional crop types.[37]
- **Water deficits could hasten conversion of agricultural land to urban uses.** Water deficits that impact agricultural production and livelihoods could hasten conversion of agricultural land to urban uses.[38]
- **Agricultural employment may be less stable.** Agriculture is the primary economic driver in Yuba County. Agricultural operators and their employees may be increasingly affected by climate-related impacts on agriculture, a water- and weather-reliant industry. According to the agadapt.edu website, created collaboratively by Yolo County and UC Davis to prepare agricultural operators for climate change effects, summer (April-August) growing degree days have risen by 500 in the last 100 years (1909 to 2009), while winter (November-February) chill hours have decreased by about

[35] California Emergency Management Agency, and California Natural Resources Agency, California Adaptation Planning Guide (July 2012). Available from: http://resources.ca.gov/climate_adaptation/local_government/adaptation_planning_guide.html

[36] Office of Emergency Services, Yuba County Multi-Jurisdictional Multi-Hazard Mitigation Plan, Yuba County, CA (2009). Available from:http://www.co.yuba.ca.us/departments/OES/PDM/Multi-hazard%20mitigation%20plan/Plan%20Documents/Section%204%20-%20Risk%20Assessment.pdf

[37] Ibid.

[38] Mehta, V.K.; V.R. Haden; B.A. Joyce; D.R. Purkey; L.E. Jackson, Irrigation demand and supply, given projections of climate and land-use change, in Yolo County, California (2012). Agricultural Water Management. 117 (2013)70-82. Available from: www.elsevier.com/locate/agwat

100 (20 percent) between 1912 and 2013.[39] Lost revenues from climate-related events will potentially negatively affect regional income, employment, and tax revenues.

Hydropower Production

- **Climate impacts on high-elevation hydropower production would have wide-ranging effects.** High-elevation hydropower production in the Sierras accounts for almost 20 percent of California's in-state energy production.[40] Impacts to that production will be felt both within and beyond the region.
- **Climate adaptation will likely require a combination of operating changes to hydrogenation facilities, with related secondary impacts to water facilities and delivery; even so, generation losses are probable.** PG&E research shows that continued operation of a mountain hydroelectric system will require adaptation to climate change specific to the region, namely a combination of operational changes, including higher winter carryover reservoir storage levels, reduced conveyance flows in canals and flumes during winter storm period, reduced reservoir releases during the late spring and summer period, and increased sediment sluicing releases from diversion dams. It is observed that as snowpack continues to disappear, in effect, the ability to fully and efficiently use reservoir storage also diminishes due to the increasing uncertainty of filling the reservoirs. Negative impacts to hydroelectric generation will likely occur with sufficient frequency to cause overall generation losses for PG&E's hydroelectric system by about 2025 on the Yuba River.[41] While it has been suggested that impacts to high-elevation systems could be mitigated by storage of enough water for generation in summer months, Freeman (2008) states that many of PG&E's forebays and afterbays are incapable of storing significant quantities of rainfall generated runoff.
- **Revenue losses from hydropower are projected.** Revenue losses from both low- and high-elevation hydropower are projected under both warm-dry and warm-only climate scenarios.[42]
- **Decreased hydropower production coupled with increased summer energy demands could affect the local economy.** Energy demands in the region would likely increase from need for air-conditioning and cooling during summer months. Major industries and institutions requiring heating and cooling could be affected, both economically and by potential losses of power, from hydropower generation losses over time.

Recreation

- **Recreational pursuits and tourism could be affected by low flows.** Recreational floating and tourism is a primary driver of the economy; 39 miles of the lower South Yuba River are designated as a California Wild and Scenic River and recommended as a federal Wild and Scenic River. Low flows brought on by warming and drying of the climate may increase competition for adequate flows to support recreational pursuits.

[39] http://agadapt.ucdavis.edu/changingclimate/

[40] Mehta, V.K.; D. E. Rheinheiimer; D.Y. Yates; D.R. Purkey; J.H. Viers, C.A. Young; and J.F. Mount. Potential impacts on hydrology and hydropower production under climate warming of the Sierra Nevada. Journal of Water and Climate Change. 02.1 (2011).

[41] Freeman, G. J., Runoff impacts of climate change on northern California's watersheds as influenced by geology and elevation-a mountain hydroelectric system perspective. Western Snow Conference 76:23-34 (2008). Available from: http://www.westernsnowconference.org/proceedings/pdf_Proceedings/2008/Freeman.RunoffImpactsOfClimateChangeOnNorthernCalifornia'sWatersheds.pdf

[42] California Climate Change Center, Water management adaptation with climate change, Prepared by: Azuara, J.M.; Connell, C.R.; Madani, K.; Lund, J.R.; and Howitt, R.E. (Final paper August 2009).

- **Projected low flows may not be sufficient to sustain FERC-licensed rafting flows, having secondary negative effects on the local economy.** Most rafting flows have been set by FERC licenses, but projected low flows may not be sufficient to sustain current-day recreational pursuits. This could have secondary negative effects on the local economy.
- **Recreational forest resources are likely to be affected by changes in flow regime.** Forest infrastructure such as bridges, culverts, campgrounds, and roads may be damaged by increased variation in flows, while recreational game fish species may be negatively affected by diminished water quality.

Timber Harvest

- **Potential climatic changes are expected to affect type, location, and amount of timber inventories, but may generate need for alternative timber management/production.** Modeled data suggest potential climatic changes that are expected to shift forest types and species mixtures within the watershed. Coupled with increased fire risk and an anticipated elevation of invasive species, timber inventories could shift in type, location, and number. However, economic stimulus may come from the need for fuels reduction projects and possible local energy production from biomass.

11.3.2 Prioritizing Climate Vulnerabilities for the Region

The climate Core Group met in March 2014 to consider prioritization of climate vulnerabilities. The Group first reviewed and modified the list of vulnerabilities that had been filled out by stakeholders using the framework of DWR's Climate Checklist (see **Appendix 11-1**) from DWR's Climate Handbook and a table of vulnerabilities and adaptation strategies that had been previously posted and reviewed by stakeholders.

The project team explained that DWR requires prioritization of climate vulnerabilities and that the recommended methodology for prioritization had taken guidance from the California Adaptation Planning Guide. A vulnerability rating system of high, medium, and low was based on the likelihood of climate impact to the issue (e.g., water supply, species and habitat); the sensitivity level for critical facilities, essential economies, sensitive species and habitats, or vulnerable populations; and the level of risk for public safety, economic sectors, the environment, or critical facilities.

The Group subsequently rated all vulnerabilities and completed a table with its recommendations as displayed in **Table 11-5**.

Table 11-5. Yuba County IRWMP Climate Vulnerability Prioritization					
Vulnerability	**Likelihood of occurrence: Are climate effects occurring or projected within a 50-year timeframe?**	**Sensitivity Level: Does this involve critical facilities, essential economies, sensitive species and habitats, or vulnerable populations?**	**Level of Risk: Could this involve critical public safety, severe economic or environmental damage, and/or critical facility loss?**	**Priority** **High (H), Medium (M), Low (L)**	**Justification**
Water Supply/Demand					
Reduced streamflow and water supply will likely generate hard choices for water managers, and potentially increase conflicts among agricultural, domestic, hydropower, flood control, and environmental needs. State water policies and out-of-region demands (e.g., Sacramento-San Joaquin Delta) could affect water supply management as much as the direct effects of climate change. Decreased surface flows from climate change could increase future groundwater demands and out-of-area transfer demands.	Earlier Sierra snowmelt is occurring and is a primary contributor to regional surface flows. The runoff season is shifting from March-June to a February-May period; this shift is projected to become more pronounced as the climate warms. Valley groundwater supplies could be affected during prolonged droughts and decreased snowpack and rain versus snow events; shallow wetland habitats are currently affected. During drought conditions foothill communities have required water rationing.	In foothill communities, wells are a significant water supply source. Several regional imperiled species are wetland and riparian dependent.	Level of risk is high for foothill populations and some subregions — could face severe domestic and irrigation shortages. Level of risk is high for imperiled species that could further decline or disappear.	**H** for foothill communities (e.g., Camptonville), and rural areas served by private wells (e.g. Oregon House and Dobbins) **H** for wetland-dependent, riparian, and/or aquatic habitat **H** for irrigation demands in some subregions (e.g., North Yuba and Browns Valley)	Climate variation is already affecting area water supply and the impacts are expected to increase. Sensitivities to these effects on water supply exist in foothill communities, for wetland-dependent habitat, and for irrigation in specific subregions. The level of risk for local economic health and environmental damage is **high** in specific locations/districts.
Water Quality					
Reduced water quality could occur from the direct effects of rising temperatures and to the indirect effects of eutrophication, increased algal growth, release of mercury methylation, increased sedimentation from high peak winter runoff, and decreased vegetative cover	Several water bodies are state-listed as impaired for heavy metals, chemicals, and/or temperature. Several fish species exceed safety levels for human consumption from mercury bioaccumulation.	Involves sensitive species and habitats, and communities needing to treat for turbidity.	Level of risk high for localized effects on species; occasionally severe effects on communities.	**H** for localized effects on wetland, riparian, and aquatic species. **H** for rural community	Water quality is already compromised and impacts are expected to increase. Warming and drying will compound water quality problems. Imperiled species and local communities affected by turbidity in municipal water sources

Table 11-5. Yuba County IRWMP Climate Vulnerability Prioritization					
Vulnerability	**Likelihood of occurrence: Are climate effects occurring or projected within a 50-year timeframe?**	**Sensitivity Level: Does this involve critical facilities, essential economies, sensitive species and habitats, or vulnerable populations?**	**Level of Risk: Could this involve critical public safety, severe economic or environmental damage, and/or critical facility loss?**	**Priority** **High (H), Medium (M), Low (L)**	**Justification**
and resulting erosion/sedimentation due to fire. Decreased flows in some water bodies will likely result in a higher concentration of pollutants/reduced assimilative capacity.	During some peak flow events, Camptonville's and North Yuba Water District's surface supplies are compromised by turbidity. Drought and higher temperatures are projected to increase and likely will further reduce assimilative capacity and increase water temperatures.			treatment systems (e.g., Camptonville and North Yuba Water District).	are especially sensitive. The level of risk is **high** for imperiled species and occasionally severe for communities.
Flooding					
Infrastructure (water storage and conveyance)					
Water storage infrastructure was designed for historic flow regime, and may not accommodate increased winter peak flows, or have adequate carryover storage for drought periods. The conveyance system was designed for a certain demand, and inadequate peaking capacity may exist during times of extraordinary heat (for irrigation demand). Conflicts over storage may increase among agricultural, domestic, hydropower, flood control, and environmental needs.	Generally, peak flows are only a problem following wet years when reservoirs and groundwater basins are at capacity. Storage capacity varies by facility, from 1.5 to 2 years' capacity; in 2014, many facilities are suffering severe shortages. Severe drought and projected warming and drying will increase these impacts.	Involves critical flood control facilities and could affect vulnerable populations and the agricultural economy.	Level of risk is potentially severe depending on frequency of flood events	**H** for reservoirs with less than 2 years' capacity, and for communities with inadequate backup supply. **M** for New Bullards Bar.	Communities dependent on reservoirs with less than 2 years' capacity are at high risk for public health and safety and economic loss.

Table 11-5. Yuba County IRWMP Climate Vulnerability Prioritization					
Vulnerability	**Likelihood of occurrence: Are climate effects occurring or projected within a 50-year timeframe?**	**Sensitivity Level: Does this involve critical facilities, essential economies, sensitive species and habitats, or vulnerable populations?**	**Level of Risk: Could this involve critical public safety, severe economic or environmental damage, and/or critical facility loss?**	**Priority** **High (H), Medium (M), Low (L)**	**Justification**
Wildfire					
Increased fire frequency, intensity, and duration of the fire season may impact vegetative species composition, especially the size and extent of old-growth habitat and related fauna; impact water quality due to sedimentation; threaten critical facilities located in fire-prone areas; and increase chances for human and economic loss due to development in fire-prone areas. The northern two-thirds of critical facilities are exposed to fire threat hazard; several in the "very high fire hazard" category, including YCWA's Colgate Power House and Narrows #2 Power House (CDF data), and in even-aged clear-cut conifer plantations such as those located north and east of New Bullards Bar.	Up to two-thirds of Yuba County is exposed to increased fire risk from May through October annually, and the fire season has extended in recent years. Wildfire frequency, intensity, and duration are projected to increase during the planning horizon.	Wildfire threatens all sensitivity areas in the foothills.	In the foothills, wildfire threatens homes, critical facilities, habitat, and puts residents at risk.	**H** for foothills and higher elevations.	The region is already experiencing increased wildfire risk, expected to increase over the Plan horizon. Sensitive resources and communities are at **high** risk, particularly in the foothills where homes, critical facilities, and habitats are vulnerable.
Agriculture					
Regional agriculture will likely suffer from the direct climate effects of greater extremes in drought and loss of snowpack, heavier storm events, and temperature extremes. Secondary effects on agriculture	Climate impacts of increased variability in temperature, storm events, and drought are occurring or projected. Both DWR and CVP have	Significant economic losses are likely to occur. Agriculture is the	The level of risk to agriculture is high.	**H**	Level of risk is **high**: Widespread and/or high-value crop losses would affect most sectors of the local and, potentially, statewide economy due to reduced profits, job loss, and

Table 11-5. Yuba County IRWMP Climate Vulnerability Prioritization					
Vulnerability	**Likelihood of occurrence: Are climate effects occurring or projected within a 50-year timeframe?**	**Sensitivity Level: Does this involve critical facilities, essential economies, sensitive species and habitats, or vulnerable populations?**	**Level of Risk: Could this involve critical public safety, severe economic or environmental damage, and/or critical facility loss?**	**Priority** **High (H), Medium (M), Low (L)**	**Justification**
could include higher costs associated with irrigation, cooling and processing water, reduced viability for heat-sensitive crops, overall crop loss, reduced profits, local and state tax revenues, and employment. Summer irrigation demand could increase if not offset by agricultural water efficiencies, cropping techniques, and change in crop mix.	indicated no water delivery for agriculture in 2014 that will result in crop loss and increased groundwater use. Foothill communities (e.g., Camptonville) have faced summer water shortages during drought conditions; water rationing has been required.	primary economic driver of the region. Could also affect DACs, such as farming and non-English speaking communities.			reduced tax revenues. DACs may suffer the greatest impacts from job loss. Foothill agriculture may suffer the most prolonged effects due to recurring water shortages.
Species and Habitat					
Warming and drying are causing fragmentation and/or degradation of habitat for stream-dependent species and, in particular, species restricted in their ability to move or re-adapt (e.g., amphibians). Increased water temperatures are also affecting aquatic species such as spring-run Chinook salmon. **Increased demand on groundwater may desiccate groundwater-dependent ecosystems.** Greater colonization and numbers of both	Upslope movement of vegetative communities is occurring or anticipated as temperatures rise during Plan horizon. Significant changes in bird distribution and composition (especially wetland-dependent species), and substantial impacts to amphibians are occurring or anticipated during Plan horizon.	Involves sensitive species and federally listed species already at risk.	High level of risk for imperiled habitat and species, especially wetland-dependent, riparian, and aquatic species and habitat.	**H** for severely imperiled habitat and species, especially for wetland-dependent, riparian, and aquatic species. **M** for species and habitat covered by the Yuba Accord.	Climate impacts of increased variability in temperature, storm events, and drought are occurring or projected, and are already impacting habitat and species. Sensitive populations of imperiled species are at **high** risk, especially wetland-dependent, riparian, and aquatic species. **Medium** for species covered by the Yuba Accord. Minimum in-stream flows are routinely met in the Yuba River in compliance with the Yuba Accord and FERC-license conditions. This may be impacted by climate

Table 11-5. Yuba County IRWMP Climate Vulnerability Prioritization					
Vulnerability	**Likelihood of occurrence: Are climate effects occurring or projected within a 50-year timeframe?**	**Sensitivity Level: Does this involve critical facilities, essential economies, sensitive species and habitats, or vulnerable populations?**	**Level of Risk: Could this involve critical public safety, severe economic or environmental damage, and/or critical facility loss?**	**Priority** **High (H), Medium (M), Low (L)**	**Justification**
terrestrial and aquatic invasive species is expected, favored by warming and drying conditions.					warming and drying, and state water regulations/policies. Research is ongoing to best identify opportunities for improvement.
Public Health and Safety					
Increased potential for risk of flooding, wildfire, and heat waves could result in human and economic losses, with the greatest effects on DACs and under-represented communities.	Flooding, heat waves, and wildfire are projected to increase during the planning horizon. The northern 2/3 of the county's critical facilities are exposed to fire-threat hazard. Development is taking place in fire-adapted vegetation, and flood-prone areas.	Elderly, young, and populations lacking resources or knowledge due to language or economic status are potentially the most vulnerable.	The level of risk is high based on existing and projected intervals and intensities of wildfires, floods, and heat waves.	**H**	Current and projected natural events suggest a high likelihood of occurrence. Sensitivities include geography and location of population and critical facilities. Level of risk is **high** for the economy and public health and safety.
Timber Harvest					
Potential climatic changes are expected to affect type, location, and amount of timber inventories, but may generate need for alternative timber management/production and fuels reduction project **New text –please vet with group.**	Upslope movement of vegetative communities is occurring or anticipated as temperatures rise during Plan horizon.	The timber industry is an important but not primary economic driver.	The timber industry will be affected, but may benefit from added fuel reduction projects.	M	The timber industry is important but not a primary economic driver. It will likely be affected, but may also benefit from additional fuel reduction projects. Affects are judged to be **medium**.

Table 11-5. Yuba County IRWMP Climate Vulnerability Prioritization					
Vulnerability	**Likelihood of occurrence: Are climate effects occurring or projected within a 50-year timeframe?**	**Sensitivity Level: Does this involve critical facilities, essential economies, sensitive species and habitats, or vulnerable populations?**	**Level of Risk: Could this involve critical public safety, severe economic or environmental damage, and/or critical facility loss?**	**Priority** **High (H), Medium (M), Low (L)**	**Justification**
Recreation					
Intermittent effects are likely on the region's recreation industry from lower summer flows, both rafting and reservoir-based use.	Low flows have occurred and may increase from warming and drying.	Recreation is an important, but not a primary economic driver. Economic impacts greatest in foothills.	Not a severe level of risk to critical resources.	**M**	Recreational floating and tourism are important drivers of the economy; however, sensitivity factors are low and risk level for damage to critical resources is **medium**.
Hydropower Production					
Climate impacts on high-elevation hydropower production will likely have wide-ranging effects. Climate adaptation will likely require a combination of operating changes to hydrogenation facilities, with secondary impacts to water facilities and delivery; even so, generation losses are probable. Revenue losses from hydropower are projected. Decreased hydropower production coupled with increased summer energy demands could affect the local economy	PG&E currently experiencing hydrogeneration impacts due to drought and projects additional impacts to hydrogenation at some facilities by 2025.	Involves critical facilities. Costs could rise, particularly affecting DACs and the local economy in general.	Medium-term risks to economy; long-term risks from water-supply trade-offs to other sectors.	**M**	Although this may become a high priority vulnerability, the level of risk, timing of risk, and lower sensitivity were judged to make this a **medium** priority at this time. Secondary impacts will occur to DACs in particular and to the local economy in general.

11.4 Adaptive Management Strategies

As discussed above, the identification of regional climate vulnerabilities logically required development of adaptation strategies. The adaptation strategies discussed below were developed to aid the region in becoming more climate-resilient and in fortifying itself against climate impacts. A summarized list of adaptive management strategies is included in **Table 11-4**.

The project team and SEI investigated several avenues to address adaptation approaches for the Yuba County IRWM region: 1) existing strategies employed by entities, agencies, and NGOs; 2) state- and locally generated adaptation strategies that help fulfill water planning goals and mandates; 3) strategies identified during climate Core Group (RDS) participatory exercises; and 4) conversations with stakeholders during the project development process.

Many of the strategies identified in **Table 11-4** are currently underway. For example, YCWA 1) has adopted a Groundwater Management Plan that includes Basin Management Objectives aimed at protecting groundwater quality and quantity, 2) has investigated water conservation credits[43] that induce conservation in irrigation practices, 3) monitors groundwater quality and quantity, and 4) conducts basin water transfers to stabilize regional groundwater.

The region's water delivery system is complex, intertied, and variable, and therefore limited or restricted capacity exists for adaptive management to address projected climate change impacts. Adaptive management usually requires flexible infrastructure and flexible management policies and approaches. Further, higher elevation storage was built with the assumption that snowpack would be a reliable, slow-release "reservoir" lasting through June or July.

Mid-elevation infrastructure is usually built to accommodate multiple management considerations, which could include flood flows, recreational use, municipal/industrial/institutional water supply, agricultural water supply, hydropower needs, and the capacity for pumped storage. While more flexibility may exist here, competition for use may lead to individual sector sacrifice. Infrastructure in lower elevations, below the snow line (about 1,000 feet), may have the greatest potential for adaptive management.

As well, programs to remove sediment to maintain or increase storage capacity are being proposed in SB 848, the Safe Drinking Water, Water Quality and Water Supply Act of 2014, and the Wolk water bond.

11.4.1 Adaptation Strategies Developed by SEI/Climate Core Team

For purposes of future WEAP modeling and to address some of the most pressing climate vulnerabilities in the region, SEI and the Climate Core Group identified several plausible regional adaptation strategies. These strategies may benefit from further refinement during future WEAP modeling under differing climatological, social, and regulatory scenarios. Additional adaptation strategies are included in **Table 11-4.**

[43] Irrigation Training and Research Center, Yuba County Water Agency Water Conservation Credit Study. Prepared by: Dr. Charles Burt and Monte Solo, California Polytechnic State University, San Luis Obispo, CA (August 2009). Prepared for: Yuba County Water Agency.

Water Supply

Additional Storage Projects: Small storage projects, such as suggested on Dry Creek and New York Flat, would offer additional capacity to capture water during big flood events, as well as increase the overall annual storage capacity of the system to increase flexibility of supply and deliver during dry years. However, such infrastructure projects are costly and may disrupt aquatic habitat as well as in-stream flows downstream.

Water Conservation/Recycled Water: Conservation techniques are important strategies in sustainable water management and can often be less costly ways to supplement water supply than constructing new storage infrastructure. One proposed technique within the Yuba basin is the lining of irrigation canals, or converting them to closed pipe conveyances. One such project has already been implemented by the Browns Valley Irrigation District (BVID): construction of the Upper Main Water Conservation Project, which consisted of a new pipeline to convey water that previously would have traveled through the open and unlined Upper Main Canal. An estimated 3,100 af of water was conserved as a result of this project, water that had been lost to evaporation, seepage, and consumptive use by vegetation adjacent to the canal. This extra water is now available for use by BVID, which has proposed a transfer plan of the water in coming years to generate income for the district. This transfer water is exported downstream of the Feather River confluence, and thus contributes to in-stream environmental flows as well, and may be released in a more ecologically advantageous way.

Potential issues with such projects pertain to the cost of implementation, as well as the loss of local groundwater recharge from the seepage in unlined canals. In areas where soils are highly permeable and seepage losses are high, such a project would greatly increase conveyance efficiency, and be a viable option, but the potential impacts on the local water table would need to be well-understood before implementation. In many areas on the valley floor and adjacent to major waterways, where fine-grained alluvial clays are dominant and seepage losses are minimal in unlined canals, such projects may not be a preferable option.

Recycled water is another method of conservation, which may be implemented to achieve multiple benefits. Water may be recycled by municipalities (e.g., by outdoor irrigation/purple pipe systems), or by agricultural members, such as seen in the BVID proposed Agricultural Return Flow Recapturing Project that aims to capture and pump water from Dry Creek just before the confluence with the Lower Yuba River, and potentially achieve benefits for agricultural yield as well as the ecological well-being of the river system.

Other conservation efforts, such as public awareness, restrictions on landscaping, alternative cropping techniques, and on-farm technology (e.g., drip system irrigation) may serve as effective tools in both adding resilience in the face of climate change and changing water-use demands, as well as preventing the need for more storage infrastructure. One compelling example of on-farm conservation is seen in Southern California as part of the Quantification Settlement Agreement, in which the City of San Diego, with its growing urban water demand, offered to fund farm-conservation techniques in the Imperial Valley Irrigation District (IVID). The outcome was that IVID farm production remained constant while requiring less water, with this saved water then transferred to the City of San Diego. Such transfers are becoming increasingly common throughout the state as urban populations grow, and provide opportunities for multi-benefit solutions such as this.

***New Bullards Bar Mid-Level Outlet*:** YCWA is considering retrofitting New Bullards Dam with a new mid-level outlet, which would allow for the faster release of water in the dam in the event of a flood.

Currently the dam is required to maintain at least 170 af of empty storage space from September 30 to March 31 due to flood protection concerns. However, if the release capacity were increased, YCWA could potentially capture and store more water, even during the flood season, with the ability to more quickly release water in the event of a flood which threatened dam stability. With spring snowmelt recession making more runoff occur before March 31, when current storage capacity is limited due to these flood space restrictions, it may become increasingly difficult to capture and store enough runoff in New Bullards to meet summer irrigation demands, especially in dry years. Other potential benefits of this project may be the higher potential for water temperature mixing to favor aquatic habitat from dam releases with this new release gate. However, the effects that such an outlet could have upon reservoir release operations may prove harmful for downstream ecosystems, especially if late-winter and early-spring outflows are reduced due to potentially reduced flood-pool requirements.

Dredging Reservoirs: While rates of sedimentation throughout the basin have decreased in recent decades, recent sedimentation studies on Englebright Lake have estimated that more than 25 percent of the reservoir's original storage capacity has been filled in. While the dam itself was originally built to trap sediment, as much of it is highly laden with toxic pollutants (i.e., mercury), it may be beneficial to begin dredging some of this sediment both to increase the storage capacity of the reservoir in the face of changing flood and drought patterns, as well as to begin efforts to remove this toxic material from the system. If future environmental regulations mandate the removal of Englebright Dam, such a process will have to be done to mitigate the effects that sediment would have downstream. However, Englebright is not currently undergoing the FERC-relicensing 2016 process, and such decisions may sooner be influenced by pending Biological Opinions from the National Marine and Fisheries Service.

Flooding

Upgrade Levees**:** As existing levees become older and less stable, FEMA regulations become more stringent, and climate models project larger and more unpredictable flood events, upgrading or replacing existing flood-protection infrastructure is an important piece in integrated management of the region. The main benefits are to human safety and protection of urban and agricultural land. However, older levees tended to be constructed without considering the effects they would have upon the adjacent aquatic habitats, both by channelizing the river, causing incision, and disturbing in-channel habitat, as well as cutting off access to floodplains when high discharges occur. Floodplains are highly productive and nutrient rich environments that are of great benefit to fish and other aquatic species during flood events. Floodplains also serve to buffer high flows. The replacement of existing levees can achieve ecological benefits while providing flood protection. Building set-back levees, while expensive, offers potential long-term benefits for flood protection, groundwater recharge, and the ecosystem.

Headwaters Meadow Restoration: Restoring meadows in the Yuba headwaters region offers similar benefits of flood attenuation by increasing the storage capacity of headwater soils and decreasing the rates of runoff that occur during storms. Historical impairment of these meadows has contributed to downstream erosion, conversion to drier vegetation types, loss of aspen communities, reduced groundwater recharge, decreased ability to filter contaminants (especially from the legacy of gold mining in the region), and decreased base-flows coming from the upper basins, especially in drier months, which will become increasingly problematic as spring snowmelt continues to recede. Restoration of meadow ecosystems improves vegetation conditions and would also likely decrease sedimentation rates downstream, helping to preserve existing storage space in existing storage reservoirs.

Wildlife and Habitat

***Off-Channel Salmon Habitat*:** As described in the levee upgrading section, many benefits to the ecosystem may be achieved by increasing access to floodplains and off-channel areas for aquatic species. For example, recent research in California has shown that rice fields adjacent to waterways may be used to simulate floodplains, and provide great opportunities for off-channel salmon rearing and migratory waterfowl habitat, as well as buffering flood-flows. Juvenile salmon reared in these fields exhibit much higher growth rates than those living only in main river channel without access to floodplains. In addition, the waterfowl activity has been shown to assist in the decomposition process of the rice fields. This is an example of an innovative management strategy which provides significant flood, agricultural, and environmental benefits, at a relatively low cost.[44] However, improving access to existing natural floodplains and other side-channel or oxbow channel is the most beneficial strategy to increase access to nutrients and habitat, and should be prioritized before alternatives are explored.

***Dam Removal (Daguerre Point)*:** While not under immediate scrutiny in the Yuba Development Project FERC-relicensing process, Daguerre Point Dam has long been a point of contention between environmental advocates and other water users. While providing roughly 15 to 20 feet of head for diversion canals used for irrigation to YCWA member units both to the north and south, the dam obstructs fish passage upstream, with its current fish passage infrastructure deemed largely inadequate by the US Army Corps of Engineers. A number of improvement action alternatives are assessed, including both total removal of Daguerre, as well as less costly measures such as installing a series of step-pool weir structures along the dam in order to improve passage without removing the structure itself.[45] Similar to Englebright Dam, Daguerre Point retains large amounts of potentially toxic sediment that would need to be addressed prior to its removal. It is also cited as being a source of local groundwater recharge through the highly porous sedimentary material of the neighboring Yuba Gold Fields region, and therefore understanding effects upon the local water table would need to be accounted for as well, were this dam to be removed.

Fire and Fuels

Fuel Reduction: Removing excess groundcover and vegetation (especially non-native) would benefit both native vegetation populations, as well as reduce the risk of forest fires in the upper parts of the Yuba County IRWM area watershed. As climate patterns become increasingly sporadic, and the risk of larger and more frequent forest fires becomes a real threat, it is essential to think critically about management of excess bio-material in Yuba County forests. In a dry year, excess fuel due to many past years of forest fire suppression, as well as the propagation of non-native vegetation, could result in a devastating fire similar to the neighboring Rim Fire in September 2013. This would have major impacts upon water quality as well as flood abatement, as heavily burned landscapes have very low soil-water storage capacity (due to lack of soil stability, hydrophobicity of certain ash deposits, and the absence of interception and evapotranspiration by plants) and erode easily, greatly increasing the potential for high volumes of rapid runoff that carries large amounts of sediment and increasing the potential for downstream flooding.

[44] Katz, J. The Knaggs Ranch Experimental Agricultural Floodplain Pilot Study 2011-2012 Year One Overview. Center for Watershed Sciences, University of California, Davis & California Department of Water Resources (2012)

[45] Daguerre Point Dam Fish Passage Improvement Project – Alternative Concepts Evaluation, USACE, DWR (September 2003).

Socioeconomics

Changing Cropping Practices: Altering cropping practices in the face of changing climate, markets, or regulations can be viewed both as an uncertainty as well as a management strategy. Farmers may begin to shift to more drought-resilient crops as extreme climate events become more common and unpredictable, or if environmental regulations require additional flows be made available for in-stream benefits. In addition, market demands may shift as well as legalities regarding certain crops. These changes could have various impacts upon the water demands of the region's agriculture. However, relatively little cropping shift has occurred in recent years, and further insight from stakeholders is required to identify possible crop-shift scenarios in response to various climate and regulatory uncertainties.

Local Agency and Public Involvement in State Policy and Regulatory Processes: Increasing involvement with regulatory processes and a "place at the table" during state policy discussions, as well as public awareness campaigns to encourage integrated water management outcomes within the Yuba County basin are important methods for influencing relevant water policy. Much of the regulatory uncertainties may be influenced by lobbying or offering constructive/regionally protective solutions for beneficial outcomes, and much of the vulnerability to climatic uncertainties may better be addressed through public awareness and an active citizenry. In addition, future potentially harmful developments such as natural gas exploration may be prevented or better regulated if well-scrutinized and/or addressed by the public.

Increased Monitoring: General monitoring of both surface and groundwater processes and quality is an essential foundation to truly integrated basin management, as it provides transparency as to the actual effects of various physical processes or human activities. Reliable basin-wide data collection is one of the best tools for informing the best management or development strategies, and can help engage the public to participate in their water management as well. Monitoring ecosystem and species response to management actions is equally important as it helps to gauge how management actions are impacting or benefits species and ecosystems that rely on healthy water quality and hydrologic function.

11.5 Strategies Elevated To Programs or Projects in This Plan

Table 13-2 lists the potential climate adapt strategies that could be used to address climate effects within the region. As the Plan progressed, representative projects emerged that address the majority of these listed adaptive strategies, as shown in Chapter 14 *Project Application, Development, and Review*, **Table 14-2**.

These project review criteria within the table were used to evaluate the merit and benefits of proposed projects, and included a criterion that evaluated whether the project would help ameliorate the effects of climate change. All projects listed in this Plan will, to a greater or lesser degree, help reduce climate impacts, and many are likely to reduce GHG emissions.

11.5.1 Risks of the Region Taking No Action

Projected increases in temperature, larger more intense storms, decreased snowpack at lower elevations, earlier timing of spring runoff, increased evapotranspiration, greater occurrence of flooding

from higher intensity storm events and greater climate variability, changes in flora and fauna, and increased forest fire risk[46] are all identified as potential regional climate impacts.

Taking no action to curb the climate vulnerabilities identified in this Plan could result in both minor and major climate-related impacts on quality of life, human safety, the local and regional economy, and natural systems and wildlife species. Implementing projects identified in this Plan can enhance resilience (protecting habitat for endangered fish and wildlife), and potentially save lives and property (e.g., flood-mitigation projects).

Actions not taken by the region also affect the remainder of the state. By 2020, projections indicate that water demand in California will exceed supply by more than 2.96 billion cubic meters.[47] Therefore, cumulative water savings and efficiencies effected in the Yuba County IRWM region could contribute to the state's ability to support its citizens and economy. Further, the state has adopted several climate and GHG-reduction goals and objectives to address climate impacts. Failure of the Yuba County IRWM region to contribute toward climate mitigations could reduce the overall ability to meet these goals and objectives and their beneficial outcomes.

11.6 Climate Change Mitigation/Greenhouse Gas Reduction

11.6.1 Mitigation Strategies

California Water Code Section 10504 specifically states that IRWM Plans are required to include GHG emissions of identified programs and projects. As discussed previously, Executive Order S-3-05, and subsequently AB 32 established GHG reduction targets so that by 2050, GHG emissions would be reduced 80 percent from 1990 levels in California. Further, as SB 97 directed lead agencies to determine baseline conditions and levels of significance for GHGs and to evaluate mitigation measures. Lead agencies need to establish these levels of significance (see Section 11.6.3 Environmental Compliance). To comply with these directives, this section discusses relevant measures that can address GHG emissions related to water management in the Yuba County IRWM region.

The Scoping Plan prepared by CARB identifies recommendations relating to different sectors, of which the water supply, sustainable forests, and agriculture recommendations are most relevant to this region. In particular, six GHG mitigation strategies are suggested for the water sector, that if implemented could substantively reduce GHG emissions:

- water use efficiencies;
- water recycling;
- water system efficiencies;
- reuse of urban runoff;
- increased renewable energy production; and
- public good charge.

[46] Ibid.

[47] Mehta, V.K.; V.R. Haden; B.A. Joyce; D.R. Purkey; L.E. Jackson, Irrigation demand and supply, given projections of climate and land-use change, in Yolo County, California (2012). Agricultural Water Management, 117, 70-82 (2013). Available from: www.elsevier.com/locate/agwat

Yuba County water agencies are already responding to the Scoping Plan mitigation measures, in large part through their respective Urban Water Management Plans. These plans contain targets for reducing per capita use over time, and for water system efficiencies.

The largest forest management agencies in the region, the Plumas and Tahoe National Forests, currently consider climate effects on forest management and maintaining opportunities for carbon sequestration to reduce GHG emissions.

CARB strategies associated with agriculture typical of this region include improving fuel efficiency of on-farm equipment, water-use efficiency, and carbon sequestration from restoration of riparian and forested areas. As previously mentioned, a water-use efficiency project, the Upper Main Water Conservation Project, has already been implemented by the BVID. This consisted of a new pipeline to convey water that previously would have traveled through the open and unlined Upper Main Canal. It is estimated that roughly 3,100 af of water was conserved as result of this project, water that had been lost to evaporation, seepage, and by vegetation adjacent to the canal. BVID has proposed a future transfer plan of the conserved water to generate income for the district. This transfer water is exported downstream of the Feather River confluence, and thus contributes to in-stream environmental flows as well.

BVID has also proposed an Agricultural Return Flow Recapturing Project that aims to capture and pump water from Dry Creek just before the confluence with the Lower Yuba River, and potentially achieve benefits for agricultural yield, as well as for the ecological well-being of the river system.

Regional NGOs in cooperation with the US Forest Service have also played a substantive role in stabilizing regional ecosystems that help capture carbon, and thus reduce GHGs. American River Conservancy, South Yuba River Citizens League, and Sierra Streams Institute have accomplished forest restoration and protection projects relevant to this issue.

Moreover, Yuba County's 2030 General Plan Update contains numerous policies that would promote consistency with AB 32 and that may now or in the future overlap with GHG reduction mitigations in this Plan. A snapshot of some of the most relevant policies is displayed below:

- Policy NR7.11: "The County and Yuba County Water Agency should explore opportunities related to future access to hydroelectric power, energy provision; strategic use of local energy resources for employment development, and other programs that have dual environmental-economic benefits."
- Policy NR12: "The County will encourage financing programs designed to facilitate the installation of renewable energy systems, including those that establish a benefit district and allow property owners to repay over the long term through a special assessment on the property tax bill."
- Action NR7.13 addresses energy efficiency in the public realm and includes a statement that, "The County will also consider the feasibility of using fees or actions required to meet County greenhouse gas efficiency policies on a fair-share basis to fund energy efficiency improvements and renewable energy systems in existing developed buildings and the public realm."
- Policy NR132.4: "The County will also encourage the use of recycled water for outdoor irrigation, toilet flushing, fire hydrants; commercial and industrial processes, carwashes, concrete batching, laundromats; dust control; park golf courses and other landscaped areas, and other appropriate water-intensive uses."

- Policy NR12.5 and 12.5 address climate-appropriate landscaping in parks and open spaces and water conservation and efficiencies in all types of new development.
- Policy HS5.1 is a policy encouraging GHG-efficient development patterns and underscores the many policies in the General Plan encouraging efficient land use patterns, minimize travel, and support infill development and protection of agricultural land. Policy HS5.1 states that the county will use its fees and programs to encourage more GHG-efficient development patterns.
- Policy HS5.2 states that, "In evaluating operational emissions of development projects and plans, the county will use a threshold of an annual net increase of 6.4 metric tons of CO_2 equivalent per-capita and 4.4 per metric tons of CO_2 equivalent per service populations. This threshold does not apply to agricultural operations or processing industrial projects of other types of stationary sources.
- Action HS5.1 says that the county will adopt a plan to reduce GHG emissions.
- Action HS5.2 makes a commitment that the county will meet with local agricultural groups to discuss best practices to reduce GHGs related to agricultural production, and that it will seek funding, such as through carbon offsets, to provide incentives to local producers to participate in consensus GHG reduction.

11.6.2 GHG Reduction Considerations for Project Design and Alternatives

The Yuba County IRWM process used to consider GHG reduction among project alternatives and to mitigate for GHG emissions from projects consisted of a questionnaire to be filled out by project sponsors, based on the level of development of a specific project. Please see Chapter 14 for the project review process.

These initial vetting of GHGs offer a means of considering and incorporating mitigations to reduce projected GHG emissions among project alternatives.

IRWM Guidelines suggest that common emissions sources from projects are related to the following:

- operations of construction equipment;
- passenger vehicle trips during construction and operation;
- transportation of construction materials and equipment;
- transportation of material inputs for O&M;
- transportation of material outputs or production;
- generation of electricity used for operation of projects; and
- waste generation and disposal of materials during construction and operation.

Reduction strategies during project design and project mitigations under California Environmental Quality Act (CEQA)/National Environmental Policy Act review could include any of the applicable measures listed below:

Project construction-related transportation

- Offer local contractor preference and local purchase of construction materials where possible to reduce transportation-related emissions.
- Encourage or require carpooling within construction contracts.
- Encourage use of B20 fuels in construction equipment and other diesel machinery.
- Restrict inappropriate OHV use, particularly in sensitive or restored areas where project investments have been made.

Project construction-related emissions

- Encourage or require recycling of construction waste, such as brick, concrete, lumber, metal, and dry wall, as may be required within Yuba County from the proposed Lumber Waste Diversion Ordinance.
- Pursue projects in this Plan that would use biomass from fuels reduction projects.
- Capture sequestration opportunities with forest, sage-steppe, riparian, and grassland revegetation, stabilization, and restoration projects.

Water supply and water efficiency improvements

- Select project components and upgrades, such as pumps, based on energy efficiency.
- Schedule pumping to reduce peak hour (Noon to 5:00 p.m., highest carbon output) energy use.
- Select projects that offer the best water conservation options among project choices (e.g., greatest reuse/recycling, greatest reduction in leakage or evaporation per mile).
- Install solar generation equipment for pumping and other energy-generation needs to reduce both emissions and long-term O&M costs.
- Increase conservation/reduce water use (and thus the energy and emissions related to its delivery) with increased metering, favorable rate incentives for conservation, and education within utility bills.

11.6.3 Environmental Compliance

Senate Bill 97 directed the amendment of the CEQA Guidelines so that the effects of climate change were incorporated into environmental review. These CEQA guideline amendments became effective in March 2010, and have some flexibility; they allow a lead agency to conduct analyses at their own discretion under consideration of credible evidence. The RWMG will need to document through its project review process that: 1) emissions from a proposed project have been determined, 2) GHG mitigations have been incorporated into the project, 3) the project may help in adapting to climate change over the 20-year planning horizon, and 4) a determination of significance has been made (if available from the lead agency).

In the Yuba County IRWM region, the regulatory agency for air quality is the Feather River Air Quality Management District (FRAQMD). As of the writing of this document, FRAQMD had not yet adopted a significance threshold for GHG emissions against which to analyze projects. However, it is working with other regional air quality agencies to draft a significance threshold that can be presented to its board in fall 2014.[48]

[48] Spaethe, Sondra, pers. comm., Air Quality Planner-FRAQMD (February 13, 2014).

11.7 Climate Change Discussion Elsewhere In This Plan

Climate is addressed in several other sections of this Plan, as appropriate. Please find references to those sections in **Table 11-6**, below.

Table 11-6. Climate Change Discussion Elsewhere in this IRWMP

Item	Description	Chapter
Region Description	Section 6.6.1 describes anticipated climate impacts and vulnerabilities for the region as derived from the climate assessment in Chapter 11.	Chapter 6
Plan Objectives	Table 12-1 addressed how climate is linked to regional issues and conflicts; section 12.2.2 discusses aligning regional objectives with existing climate policies and regulations; and section 12.2.3 illustrates goals and objectives to address climate vulnerabilities and reduce GHG emissions.	Chapter 12
Resource Management Strategies	Table 13-4 discusses how resource management strategies are considered in light of climate change. Existing and proposed RMSs address water use efficiency, practice integrated flood management, and seek to enhance and sustain ecosystems.	Chapter 13
Project Review Process	Sections 14.1.1.1, 14.4 discuss how climate change is integrated and considered within the project review process, and between project alternatives.	Chapter 14
Local Water Planning	Chapter 10 discusses how available water plans address climate change. Section 10.2.1.3 specifically addresses how involving the City of Wheatland and Yuba County in the RWMG has and will likely elevate the issue of climate change in future water planning.	Chapter 10
Local Land Use Planning	Chapter 10 discusses how available land use and resource management plans address climate change. Section 10.2.1.1 specifically addresses how involving the City of Wheatland and Yuba County in the RWMG has and will likely elevate the issue of climate change in future land use and resource management planning.	Chapter 10
Plan Performance and Monitoring	Section 17.1.2 anticipates that new climate data will emerge in coming years and that the Plan will need to be revised and/or updated in light of that information.	Chapter 17
Coordination	Section 4.2.2 identifies one benefit of coordination as the ability to better manage overall watersheds for climate adaptability.	Chapter 4

11.8 Future Program for Data Gathering and Analysis of Prioritized Vulnerabilities

The Yuba County IRWM proposes a practical and attainable future climate program for enhancing the region's climate resiliency. Implementing the resource management strategies, objectives, and projects

proposed in this Plan will help assure regional adaptation to a changing climate. Further, data collection and analysis, information sharing, and GHG reductions related to water agency management and project development are practical responses to ensure the ability of the region to adapt to climate change.

The following program helps assure that the region addresses its highest priority climate vulnerabilities as well as continues to produce high-quality water, reliable water supply, clean hydroelectric energy generation, sustained healthy and diverse ecosystems, and reduced socioeconomic impacts under an altered climate future.

11.8.1 Data Analysis and Information Sharing

The localized effects of climate change will manifest in coming decades, and additional relevant information and data will be generated to supplement this Plan. Therefore, the RWMG will revisit climate projections and data in this Plan and supplement it at appropriate intervals to be determined by the RWMG. Revisions to the Plan will accommodate these new data and studies accordingly. IRWM Guidelines encourage RWMGs to stay involved with the California Natural Resource Agency's California Adaptation Strategy process and to consider joining the California Climate Action Registry at http://www.climateregistsry.org.

New information and climate-related revisions to the Plan will be shared during RWMG meetings, project development processes, and on the Yuba County IRWM website.

11.8.2 Reducing GHG Emissions

Project review criteria included in this Plan will allow project sponsors to incorporate GHG mitigations into project design and implementation. The RWMG will monitor the outcomes of project implementation over time to determine if adaptive management strategies and mitigations appear effective, based on technical input from project sponsors, and if the list of project mitigations can be supplemented as guidance for project development.

Further, as water management agencies implement their respective UWMPs and projects in this Plan, increased water efficiencies, reductions in water use, increased recycling, and other measures to reduce GHGs will likely result.

Chapter 12 *Goals, Objectives, Issues, and Conflicts*

12.0 Introduction

This chapter's purpose is to describe the process by which Plan goals and objectives were developed and their relationship to regional issues and conflicts, mandatory state plans and California Water Code requirements, project development, and performance metrics.

12.1 Building the Foundation for Effective Plan Implementation

Plan objectives form the foundation of the planning process. It is through the development of measurable objectives that the region establishes the intent and capacity to monitor Plan implementation. Plan implementation is then employed through projects that use a diverse set of regionally relevant California Water Plan (CWP) (2009 and 2013) resource management strategies to successfully address the region's identified issues and water-related conflicts. Additionally, the Regional Water Management Group (RWMG) ensures that the region's objectives are consistent and in support of mandatory state plans and Water Code requirements.

12.2 Describing the Process for Determination of Objectives

12.2.1 Addressing Regional Issues and Conflicts

Early in the Yuba County IRWMP Update process, the project team conducted in-person and phone interviews with the complement of stakeholders who had been identified through the stakeholder outreach and engagement process (see Chapter 3 *Stakeholder Involvement).* One of the central objectives of these initial interviews was to identify regional issues and water-related conflicts. Through reviewing the issues and conflicts from the original IRWMP, and by conducting more than two dozen interviews and facilitating discussions at the first and second RWMG meetings, the project team was able to generate a final issues and conflicts list by fall 2013. The project team used the list as the basis for creating draft goals and objectives that directly addressed identified issues and conflicts. **Tables 12-1** and **12-2** represent the issues and conflicts approved by the Yuba RWMG.

Table 12-1. Regionally Identified Issues	
Primary Issues	**Associated Problem Statements** **Each of the following statements is prefaced by "The need to:"**
Water Storage	▪ Develop new water storage or identify alternatives to new storage that would increase water supply as a result of projected future uncertainties.
Infrastructure	▪ Develop new infrastructure as well as repair, replace, and retrofit aging infrastructure to ensure adequate and reliable water supply.
Wastewater Management	▪ Improve wastewater management and manage water quality impacts from spills and discharges while addressing the rising costs of operation and regulatory compliance.
Water Use Efficiency/ Water Conservation	▪ Promote and implement policies and practices to increase water use efficiency *and* water conservation in municipal and agricultural sectors.
Groundwater	▪ Promote integrated management of groundwater and surface water. ▪ Educate the public to protect groundwater resources, especially from contamination and overuse. ▪ Understand where groundwater and surface water are connected and where they have been disconnected. ▪ Protect groundwater and groundwater-dependent ecosystems, especially to address the projected impacts of climate change.
Flood Management	▪ Improve integrated flood management to ensure better emergency preparedness. ▪ Increase flood protection and enhance floodplain functions and habitat. ▪ Create multi-stakeholder collaboration for flood management to achieve multiple economic, public safety, and ecological benefits.
Water Quality Contamination: Urban and Agricultural Run-off	▪ Maintain and improve water quality by mitigating for urban and agricultural runoff.
Sediment Management	▪ Manage sedimentation to maintain and/or increase water-holding capacity in reservoirs, and to implement erosion control to prevent contamination in water courses and water management operations.
Recreation	▪ Promote and implement comprehensive recreational planning with a focus on regional economic development in the Lower Yuba River and beyond to improve local economies, improve habitat, and reduce human impact and threats to public safety.
Forest Health	▪ Promote management policies and practices that protect forests and water supply and quality. ▪ Steward healthy forests, employ fire and fuels management, and restore watershed health vulnerable to the impacts of climate change.
Environmental Flows	▪ At minimum, maintain quantity, timing, and quality of stream flows required to restore and protect freshwater ecosystems.
Invasive Species	▪ Identify and manage for aquatic and terrestrial invasive species and their impacts on water supply infrastructure and watershed health.
Fisheries	▪ Recover endangered and threatened fish species, particularly anadromous fish, and restore access to historic habitat wherever feasible.

Primary Issues	Associated Problem Statements Each of the following statements is prefaced by "The need to:"
Land Use and Land Conservation	▪ Address the connection between land use planning and water. ▪ Enhance recreational and economic development opportunities through land conservation efforts. ▪ Protect working landscapes being lost to development, particularly ranch/ag lands, and the watershed benefits they provide.
Legacy Mining Toxins	▪ Address the physical and chemical hazards of abandoned mine lands with a focus on watershed-scale remediation from the most toxic mine tailings.
Regulatory Compliance	▪ Mitigate for the impacts of regulatory compliance on water management decision-making and processes, including increased costs and decreased opportunities for collaboration. ▪ Ensure a regulatory framework allowing for local and regional authority to respond to water and watershed management. ▪ Promote consistent enforcement of environmental protections to achieve the recovery of economically and culturally important species.
Climate Change	▪ Respond to projected climate change impacts on water supply reliability, water quality, public safety, and watershed health, and develop regional and interregional adaptive management strategies.

Table 12-2. Regionally Identified Conflicts	
Issues where a conflict or divergence was identified	**Characterization of Conflict/Divergence**
Water Storage	▪ Stakeholders differ over whether new storage facilities should be considered for out-of-region water transfers, and whether groundwater storage should be intentionally developed by pumping down existing aquifers.
Fisheries	▪ Stakeholders differ over how and where anadromous fish should be recovered.
Regulatory Compliance	▪ Divergence exists among stakeholders over agency requirements and how to address regulations.

12.2.1.1 Differentiating between Issues and Conflicts

For the purposes of this section, issues are defined as problems or challenges facing water resources and watershed management in the region, identified by stakeholders and confirmed by the RWMG. Conflicts are characterized by prolonged disagreement and/or seemingly divergent, irreconcilable approaches toward addressing or resolving an issue. Therefore, differing opinions, interpretations of available data, and perspectives on the significance of an issue does not inherently make an issue a conflict.

12.2.1.2 The Nature of Existing Regional Conflicts

In the Yuba County IRWM region, the aforementioned conflicts found in **Table 12-2** were not initiated within the IRWMP framework. As further described in Chapters 6 and 7, *Region Description* and *Water Supply,* respectively, conflicts surrounding fisheries and the interrelated conflicts of regulatory compliance and out-of-region water transfers have long been a source of discord in the region. Yet, even amidst protracted litigation and negotiations, diverse groups of stakeholders are engaged in dynamic, ongoing discussion and collaborations to seek solutions or viable compromise. The Lower Yuba River Accord and ongoing collaborative

multi-party processes, such as the River Management Team and the Yuba Salmon Forum, comprise some of these efforts. Disagreement persists over the National Marine Fisheries Service's Biological Opinion for Yuba River anadromous fisheries.

Stakeholders engaged in these processes are members of the Yuba County IRWM region's RWMG and have contributed to the identification of issues, conflicts, and goals and objectives for the region. The diversity of stakeholders' perspectives is reflected in the identified goals and objectives, as illustrated in **Table 12-4**. Further, these stakeholders have submitted projects for IRWMP inclusion that address these conflicts, illustrating an ongoing commitment and willingness by the RWMG to find integrated solutions to the most conflicted issues in the region. For more detailed information about projects, see Chapter 14 *Project Application, Development, and Review.*

12.2.2 Aligning Regional Objectives with Existing Plans, Policies, and Regulations

12.2.2.1 Statewide Priorities

Statewide priorities established for the IRWM Grant Program (as outlined in the IRWM Guidelines) influenced the development of the goals and objectives.[1] By consulting and integrating regionally relevant statewide priorities into the development of goals and objectives, the RWMG was able to confirm alignment of the region's measurable objectives with Basin Plan objectives, 20x2020 water efficiency and conservation goals, and requirements of the California Water Code Section 10540(c). **Table 12-3** below is taken, in part, from a table found in the IRWM Guidelines. It is inserted in this Plan to demonstrate the clear nexus between statewide priorities, Yuba County IRWM region goals and objectives, and the consistency of the regional goals and objectives with statewide plans, policies, and regulations.

Table 12-3. Statewide Priorities for Integrated Regional Water Management

Statewide Priority	Description of Priority Desired Outcomes	Relevant Plans, Policies, and Regulations
Drought Preparedness	▪ Promote water conservation, conjunctive use, reuse, and recycling ▪ Improve landscape and agricultural irrigation efficiencies ▪ Achieve long-term reduction of water use ▪ Efficient groundwater basin management ▪ Establish system interties	▪ CWP Update 2009, 2013
Use and Reuse Water More Efficiently	▪ Increase urban and agricultural water use efficiency measures such as conservation and recycling ▪ Capture, store, treat, and use urban storm water runoff ▪ Incorporate and implement low-impact development (LID) design features, techniques, and practices to reduce or eliminate storm water runoff ▪ Improve the water supply reliability of the Sacramento-San Joaquin Delta	▪ CWP Update 2009, 2013 ▪ SWRCB Recycled Water Policy ▪ DWR Sustainability Policy ▪ SB 790 ▪ Delta Reform Act 2009
Climate Change Response Actions	▪ Assessment of vulnerabilities as a result of climate change ▪ Adaptation to climate change ▪ Reduction of Greenhouse Gas (GHG) Emissions	▪ CWP Update 2009, 2013 ▪ AB 32 ▪ Managing an Uncertain

[1] The California Natural Resources Agency, Department of Water Resources, Division of Integrated Regional Water Management, Guidelines Integrated Regional Water Management Proposition 84 and 1E, page 12 (November 2012).

Table 12-3. Statewide Priorities for Integrated Regional Water Management		
Statewide Priority	**Description of Priority Desired Outcomes**	**Relevant Plans, Policies, and Regulations**
Climate Change Response Actions *(continued)*	▪ Advance and expand conjunctive management of water supply sources ▪ Water management system modifications that address anticipated climate change impacts, such as rising sea level, and which may include modifications or relocations of intakes or outfalls ▪ Establish migration corridors, re-establish river-floodplain hydrologic continuity, reintroduce anadromous fish populations to upper watershed, and enhance and protect upper watershed forests and meadow systems ▪ Reduce energy consumption of water systems and uses ▪ Use cleaner energy sources to move and treat water ▪ Water-use efficiency ▪ Water recycling ▪ Water system energy efficiency ▪ Reuse runoff	Future, DWR, October 2008
Expand Environmental Stewardship	▪ Practice, promote, improve, and expand environmental stewardship ▪ Protect and enhance the environment by improving watersheds, floodplains, and in-stream functions ▪ Sustain water and flood management ecosystems ▪ Protect, restore, and enhance the Delta ecosystem	▪ CWP Update 2009, 2013 ▪ DWR Environmental Stewardship Policy ▪ Delta Reform Act 2009
Practice Integrated Flood Management	Promote and practice integrated flood management to provide multiple benefits including: ▪ Better emergency preparedness and response ▪ Improved flood protection ▪ More sustainable flood and water management systems ▪ Enhanced floodplain ecosystems ▪ LID techniques that store and infiltrate runoff while protecting groundwater	▪ CWP Update 2009, 2013
Protect Surface Water and Groundwater	▪ Protecting and restoring surface water and groundwater quality to safeguard public and environmental health and secure water supplies for beneficial uses ▪ Salt and nutrient management planning as a component of an IRWMP	▪ SWRCB Recycled Water Policy
Improve Tribal Water and Natural Resources	▪ The development of Tribal consultation, collaboration, and access to funding for water programs and projects to better sustain Tribal water and natural resources	▪ CWP Update 2009, 2013
Ensure Equitable Distribution of Benefits	▪ Increase the participation of small and disadvantaged communities (DACs) in the IRWM process ▪ Develop multi-benefit projects with consideration of affected communities and vulnerable populations ▪ Contain projects that address safe drinking water and wastewater treatment needs of DACs ▪ Address critical water supply or water quality needs of California Native American Tribes within the region ▪ Help meet state policies intended to provide access to safe, clean, and affordable water	▪ CWP Update 2009, 2013 ▪ AB 685

12.2.2.2 Local and Regional Plans

In addition to ensuring consistency with California plans, policies, and regulations, the RWMG also aligned goals and objectives with local and regional planning documents, namely, the Yuba County General Plan (2011), the Yuba County Parks Master Plan (2008), the Yuba County Groundwater Management Plan (2005), the Yuba County Agricultural Water Management Plan (2012), and the Feather River Regional Flood Management Plan (2013 draft). Some of the municipalities in the region are subject to Urban Water Management Plans (UWMPs). The goals and objectives of this IRWMP are also consistent with local UWMPs. See Chapter 10 *Water and Land Use Planning* for further discussion of the IRWMP's relations to relevant local and regional plans.

Further, to ensure alignment of local and regional plans with Plan implementation efforts, the project development process explicitly incorporated the identification of these and other planning documents, assessments, and studies into the determination of project feasibility and as a criterion in the Project Review Criteria. See Chapter 14 *Project Application, Development, and Review* for more information.

12.2.3 Regionally Identified Goals and Objectives

The project team developed draft goals and objectives based on: 1) stakeholder feedback regarding the originally developed goals and objectives found in the Yuba County IRWMP (2008), 2) the approved issues and conflicts list as discussed above, and 3) consistency with local, regional, and statewide plans and regulations, as demonstrated in Section 12.2.2.

Subsequent to the project team's completion of the initial draft, the RWMG reviewed the draft goals and objectives in October 2013, further revising them at the RWMG meeting in January 2014. The goals and objectives were then finalized following a formal stakeholder comment and review period that closed in late February 2014. The final goals and objectives developed by the RWMG through this inclusive, multi-step process are illustrated in **Table 12-4**.

Table 12-4. Regionally Identified Goals and Objectives
Goal 1: Ensure adequate and reliable water supply that meets the diverse needs of the region
Objectives
1.1 Improve water supply system capacity, flexibility, and efficiency, including, but not limited to, optimizing existing water storage, upgrading and retrofitting aging infrastructure, and developing new infrastructure, where necessary
1.2 Promote water conservation and water use efficiency by instituting various techniques including, but not limited to, groundwater recharge, conjunctive management, irrigation efficiencies, municipal water conservation, water recycling and reuse
1.3 Protect and restore water supplies that support watershed health
1.4 Promote disaster preparedness and conservation planning efforts
1.5 Maintain and enhance flood control infrastructure to protect water supplies
1.6 Preserve water supplies that support recreational opportunities, ecosystem services, and agricultural uses
1.7 Support regulatory compliance with current and future state and federal water supply standards
1.8 Promote regional education and outreach regarding water supply issues and needs

Goal 2: Protect, restore, and enhance water quality for water users and in support of healthy watersheds
Objectives
2.1 Protect and improve water quality by mitigating for urban, agricultural, and wildland (sediment) run-off
2.2 Minimize water quality impacts from flood, effluent discharge, and wastewater spills
2.3 Promote recreational activities and programs that minimize or mitigate impacts to water quality
2.4 Protect and improve the water quality generated by healthy, forested watersheds
2.5 Maintain and improve water quality required to restore and protect freshwater ecosystems, fisheries, and groundwater-dependent habitat
2.6 Support regulatory compliance with current and future state and federal water quality standards
2.7 Protect public and ecosystem health from the physical and chemical hazards of Abandoned Mine Lands
Goal 3: Preserve and restore watershed health and promote environmental stewardship
Objectives
3.1 Steward healthy forests through fire and fuels management, erosion control measures, and wetland restoration
3.2 Identify and manage for aquatic and terrestrial invasive species and their impact on water supply infrastructure and watershed health
3.3 Recover endangered and threatened fish species through habitat restoration and by providing access to historic habitat, wherever feasible
3.4 Enhance floodplain function and wildlife habitat while achieving multiple flood management benefits and maintaining public safety
3.5 Promote watershed-level remediation of legacy mining toxins
3.6 Support environmental protections to prevent the extinction of economically, ecologically, and culturally significant species and communities
3.7 Steward the region's biodiversity and ecological resources that directly provide opportunities for public access, recreation, and education while maintaining the co-equal objectives of flood protection and preservation of agricultural lands
Goal 4: Enhance regional economic development by supporting recreational opportunities and sustainable agriculture
Objectives
4.1 Promote comprehensive recreation planning and implementation with a focus on regional economic development
4.2 Enhance river access points to encourage recreational use while preserving flood control/water storage infrastructure and managing for human impacts to watershed health
4.3 Create river corridor linkages while enhancing migration corridors for plants and animals
4.4 Explore opportunities to increase water-dependent tourism throughout the region while building local communities' capacity to manage their recreational amenities
4.5 Protect and restore working landscapes, particularly ranch/ag lands, and the watershed benefits they provide
4.6 Promote regulations that support local and regional economic resiliency by working with and among regulatory agencies to: 1) reduce regulatory conflicts, 2) ensure consistent enforcement of regulations, and 3) reduce costs and difficulty of meeting regulatory compliance
Goal 5: Protect public safety through emergency and drought preparedness and integrated flood management
Objectives
5.1 Improve integrated flood management to ensure emergency preparedness, increase flood protection, and enhance regional and interregional collaboration
5.2 Support regional and interregional collaboration to improve drought and emergency preparedness

Goal 6: Address climate vulnerabilities and reduce greenhouse gas emissions
Objectives
6.1 Support efforts to reduce greenhouse gas emissions in the region, particularly those related to water management operations
6.2 Improve data, modeling, and technical analyses to better understand the impacts of climate change on regional and interregional water supply and watershed health
6.3 Increase system flexibility and resiliency to adapt to climate variability
6.4 Promote alternative energy and energy efficiency throughout the region
6.5 Promote education about climate change/variability and its impacts on water management and watershed health throughout the region
6.6 Promote regional and interregional collaboration to implement climate change adaptive management strategies
Goal 7: Promote equitable distribution of resources to disadvantaged communities and Tribes across the region
Objectives
7.1 Support DAC and Tribal project development/implementation activities by providing ongoing outreach, proposal, and funding development assistance and training
7.2 Prioritize ongoing participation of DACs and Tribes in the Regional Water Management Group
7.3 Foster partnerships to build the capacity of DACs and Tribes throughout the region to manage their own recreational amenities
7.4 Promote regional education and outreach in collaboration with DACs and Tribes

12.3 Prioritization of Objectives

Throughout the IRWMP Update process, the RWMG has consistently discouraged the prioritization of IRWMP objectives, perceiving that this practice would result in unnecessary conflict among RWMG entities. Furthermore, a prioritization or ranking of objectives can erode efforts to promote integrated, multi-objective solutions to water and watershed management issues. Just as Resource Management Strategies are inherently interrelated, so too are the objectives. Many of the complex issues facing water and watershed management in the region require multi-objective solutions. Therefore, the prioritization of objectives has not been viewed as an effective approach to Plan implementation in the Yuba County IRWM region.

12.4 Integration of Issues, Goals, and Objectives into the Project Development Process

The central means of implementing the IRWMP is through project implementation, making it essential for the project development process to be aligned with the development of issues, goals, and objectives. From the outset of the process, the project team emphasized, and the RWMG concurred with, the importance of identifying regional issues and conflicts, which formed the basis for the development of goals and objectives, before officially commencing the project development process.

This approach enabled the RWMG to confirm the issues and conflicts and draft goals and objectives before submitting projects for Plan inclusion consideration. This sequenced strategy made it possible for project sponsors to demonstrate through the project application process (*Project Solicitation Form*) how their proposed projects addressed the regionally identified issues while meeting the goals and measurable

objectives. Also, the Project Review Criteria require project sponsors to illustrate how individual projects meet multiple objectives (Criterion #1). This streamlined, explicit structure further enables the region to concretely illustrate how successful project implementation provides assurance of effective Plan implementation and performance. For more information about the project development process and Plan performance, see Chapters 14 and 17, *Project Application, Development, and Review* and *Plan Performance and Monitoring*, respectively.

12.5 Goals, Objectives, and Performance Measures

As stated above, IRWMPs are implemented through projects designed to achieve measurable objectives. **Table 12-5** illustrates both quantitative and qualitative performance metrics associated with each objective. All Yuba County IRWMP projects have been developed to meet the regional objectives and to be measured accordingly by each objective's corresponding performance measures. The process by which the Plan and Performance Measures were developed and approved can be found in Chapter 17 *Plan Performance and Monitoring*.

Table 12-5. The Relationship between Objectives and Performance Measures

Goals and Objectives	Performance Metrics
Goal 1: Ensure adequate and reliable water supply that meets the diverse needs of the region	
Objectives	
1.1 Improve water supply system capacity, flexibility, and efficiency, including, but not limited to, optimizing existing water storage, upgrading and retrofitting aging infrastructure, and developing new infrastructure, where necessary	▪ Acre-feet per annum of water supply conserved or enhanced ▪ Acre-feet per annum water supply conserved per household ▪ Number of projects implemented ▪ Reduction in water system operational costs ▪ Tons of carbon sequestered or emissions avoided
1.2 Promote water conservation and water use efficiency by instituting various techniques including, but not limited to, groundwater recharge, conjunctive management, irrigation efficiencies, municipal water conservation, water recycling and reuse	▪ Acre-feet per annum of water supply conserved ▪ Number of projects implemented ▪ Number of collaboratively developed plans and assessments ▪ Reduction in water system operational costs ▪ Tons of carbon sequestered or emissions avoided
1.3 Protect and restore water supplies that support watershed health	▪ Acre-feet per annum of water supply conserved or enhanced ▪ Miles of stream where streamflow improved or protected ▪ Number of projects implemented ▪ Number and frequency of monitoring and assessment
1.4 Promote disaster preparedness and conservation planning efforts	▪ Number of collaboratively developed plans, studies, and assessments ▪ Number of stakeholders collaborating in the development of interregional drought response ▪ Number of planning efforts resulting in project implementation ▪ Number and diversity of people reached ▪ Number and diversity of outreach materials developed ▪ Measurable changes in knowledge or behavior
1.5 Maintain and enhance flood control infrastructure to protect water supplies	▪ Number of water supply facilities protected ▪ Number of collaboratively developed plans and

	assessments ▪ Number of stakeholders collaborating in the development of interregional flood response ▪ Number of planning efforts resulting in project implementation
1.6 Preserve water supplies that support recreational opportunities, ecosystem services, and agricultural uses	▪ Number of new, improved, or preserved economic activities ▪ Number of jobs created ▪ Acre-feet per annum of water supply conserved or enhanced ▪ Miles of stream where streamflow improved or protected ▪ Number of projects implemented
1.7 Support regulatory compliance of state and federal water supply standards	▪ Number of projects implemented that comply with state and federal water supply standards ▪ Number of collaboratively developed plans and assessments ▪ Number and frequency of monitoring and assessment
1.8 Promote regional education and outreach regarding water conservation, water supply issues and needs	▪ Number and diversity of people reached ▪ Number and diversity of outreach materials developed ▪ Measurable changes in knowledge or behavior
Goal 2: Protect, restore, and enhance water quality for water users and in support of healthy watersheds	
Objectives	
2.1 Protect and improve water quality by mitigating for urban, agricultural, and wildland (sediment) run-off	▪ Mass pollutant reduced per year ▪ Number of BMPs implemented ▪ Number of projects implemented ▪ Increased water quality monitoring and sampling ▪ Measurable improvement in water quality
2.2 Minimize water quality impacts from flood, effluent discharge, and wastewater spills	▪ Mass pollutant reduced per year ▪ Measurable improvement in water quality ▪ Reduced number of violations for water quality standards ▪ Number of BMPs implemented ▪ Number of water supply facilities protected ▪ Number of wastewater treatment plants designed to revised specifications considering climate change
2.3 Promote recreational activities and programs that minimize or mitigate impacts to water quality	▪ Number and frequency water quality monitoring and sampling ▪ Number and diversity of people reached ▪ Number and diversity of outreach materials developed ▪ Measurable changes in knowledge or behavior
2.4 Protect and improve the water quality generated by healthy, forested watersheds	▪ Number of fire and fuels management and watershed restoration projects implemented ▪ Linear feet of streambank protected or restored ▪ Mass pollutant reduced per year ▪ Acres of land treated, improved, or restored ▪ Number and frequency of water quality monitoring and sampling ▪ Number of BMPs implemented ▪ Measurable improvement in water quality

2.5 Maintain and improve water quality required to restore and protect freshwater ecosystems and fisheries	▪ Miles of stream protected or restored ▪ Number and frequency of water quality monitoring and sampling ▪ Number of BMPs implemented ▪ Measurable improvement in water quality ▪ Acres of riparian habitat and/or floodplain protected, restored, or created ▪ Number of collaboratively developed plans, studies, and assessments ▪ Mass pollutant reduced per year
2.6 Support regulatory compliance with state and federal water quality standards	▪ Number of projects implemented to comply with state and federal water quality standards ▪ Number of collaboratively developed plans and assessments ▪ Number and frequency of monitoring and assessment ▪ Decrease in water quality violations ▪ Mass pollutant reduced per year ▪ Plant certification achieved
2.7 Protect public and ecosystem health from the physical and chemical hazards of Abandoned Mine Lands (AMLs)	▪ Number and acres of Abandoned Mine Land sites improved or restored ▪ Mass pollutant reduced per year ▪ Measurable improvement in water quality
Goal 3: Preserve and restore watershed health and promote environmental stewardship	
Objectives	
3.1 Steward healthy forests through fire and fuels management, erosion control measures, wetland and groundwater-dependent ecosystems restoration	▪ Acres of land treated, improved, or restored ▪ Miles of stream protected or restored ▪ Acres of riparian habitat and/or floodplain protected, restored, or created ▪ Tons of carbon sequestered ▪ Number of projects developed or implemented ▪ Number of BMPs implemented ▪ Increased monitoring, sampling, and data analysis ▪ Measureable groundwater recharge
3.2 Identify and manage for aquatic and terrestrial invasive species and their impact on water supply infrastructure and watershed health	▪ Monitoring, sampling, and data analysis ▪ Number of collaborative plans, studies, and assessments developed ▪ Number of acres treated, improved, or restored ▪ Acres of riparian habitat and/or floodplain protected, restored, or created ▪ Number of projects implemented ▪ Number of BMPs implemented
3.3 Recover endangered and threatened fish species through habitat restoration and by providing access to historic habitat, wherever feasible	▪ Miles of stream protected or restored ▪ Acres of riparian habitat and/or floodplain protected, restored, or created ▪ Number of projects developed or implemented ▪ Acre-feet per annum streamflow improved ▪ Number of collaborative plans, assessments, studies developed ▪ Increased monitoring, sampling, and data analysis

3.4 Enhance floodplain function and wildlife habitat while achieving multiple flood management benefits and maintaining public safety	▪ Tons of carbon sequestered ▪ Miles of stream protected or restored ▪ Acres of riparian habitat and/or floodplain protected, restored, or created ▪ Number of projects developed or implemented ▪ Number of collaborative plans, assessments, studies developed ▪ Measurable groundwater recharge ▪ Lowered flood insurance rates, flood danger, and flood risk
3.5 Promote watershed-level remediation of legacy mining toxins	▪ Number of projects implemented ▪ Number of collaborative plans, assessments, studies developed ▪ Mass pollutant reduced per year
3.6 Support environmental protections to prevent the extinction of economically, ecologically, and culturally significant species	▪ Number of projects implemented ▪ Number of collaboratively developed plans, assessments, and studies ▪ Number and frequency of monitoring and assessment
3.7 Steward the region's biodiversity and ecological resources that directly provide opportunities for public access, recreation, and education	▪ Number and diversity of people reached ▪ Number and diversity of outreach materials developed ▪ Number of projects implemented ▪ Measurable changes in knowledge or behavior
Goal 4: Enhance regional economic development by supporting recreational opportunities and sustainable agriculture	
Objectives	
4.1 Promote comprehensive recreation planning and implementation with a focus on regional economic development	▪ Number of collaboratively developed plans and assessments ▪ Percent of planning efforts resulting in project implementation ▪ Number of jobs created ▪ Number of businesses supporting project recreational features
4.2 Enhance river access points to encourage recreational use while managing for human impacts to watershed health	▪ Number of collaboratively developed plans and assessments ▪ Number of projects implemented ▪ Number of recreational amenities/opportunities developed ▪ Number of visitors to project recreational facilities
4.3 Create recreational river corridor linkages while enhancing migration corridors for plants and animals	▪ Number of collaboratively developed plans and assessments ▪ Number of projects implemented ▪ Miles of river enhanced
4.4 Explore opportunities to increase water-dependent tourism throughout the region while building local communities' capacity to manage their recreational amenities	▪ Number of collaboratively developed plans, assessments, and studies ▪ Number of projects implemented ▪ Number of recreational amenities/opportunities developed ▪ Number of businesses supporting project recreational features ▪ Number of jobs created ▪ Number of visitors to project recreational features

4.5 Protect and restore working landscapes, particularly ranch/ag lands, and the watershed benefits they provide	▪ Number of collaborative plans, assessments, and studies developed ▪ Number of acres treated or improved ▪ Number of acres of land preserved ▪ Number of projects implemented ▪ Number of BMPs implemented
4.6 Promote regulations that support local and regional economic resiliency by working with and among regulatory agencies to: 1) reduce regulatory conflicts, 2) ensure consistent enforcement of regulations, and 3) reduce costs and difficulty of meeting regulatory compliance	▪ Number of projects implemented that comply with state and federal regulations ▪ Number of collaboratively developed plans, assessments, and studies
Goal 5: Protect public safety through emergency and drought preparedness and integrated flood management	
Objectives	
5.1 Improve integrated flood management to ensure emergency preparedness, increase flood protection, and enhance regional and interregional collaboration	▪ Number of collaboratively developed plans and assessments ▪ Number of stakeholders collaborating in the development of interregional flood response ▪ Number of planning efforts resulting in project implementation ▪ Increased level of flood protection provided ▪ Decrease in flood insurance rates and risks ▪ Miles of levees constructed or improved ▪ Number of projects implemented
5.2 Support regional and interregional collaboration to improve drought and emergency preparedness	▪ Number of collaboratively developed plans, studies, and assessments ▪ Number of stakeholders collaborating in the development of interregional flood response ▪ Number of planning efforts resulting in project implementation ▪ Decrease in flood insurance rates and risks ▪ Increased level of flood protection provided ▪ Miles of levees constructed or improved
Goal 6: Address climate vulnerabilities and reduce greenhouse gas emissions	
Objectives	
6.1 Support efforts to reduce greenhouse gas emissions in the region, particularly those related to water management operations	▪ Tons of carbon sequestered or emissions avoided ▪ Number of collaboratively developed plans and assessments ▪ Number of projects implemented
6.2 Improve data, modeling, and technical analyses to better understand the impacts of climate change on regional and interregional water supply and watershed health	▪ Data management improved ▪ Ongoing development and expansion of climate change modeling throughout the region ▪ Technical analytical capacity increased
6.3 Increase system flexibility and resiliency to adapt to climate variability	▪ Number of collaboratively developed plans, studies, and assessments ▪ Number of projects implemented ▪ Number of adaptive strategies implemented in the region and interregionally

6.3 *(continued)*	▪ Number and frequency of monitoring, sampling, and analysis
6.4 Promote alternative energy and energy efficiency throughout the region	▪ Kilowatts of renewable energy production capacity created ▪ Tons of carbon sequestered or emissions avoided ▪ Number of projects developed or implemented
6.5 Promote education about climate change and its impacts on water management and watershed health throughout the region	▪ Number and diversity of people reached ▪ Number and diversity of outreach materials developed ▪ Measurable changes in knowledge or behavior
6.6 Promote regional and interregional collaborations to implement climate change adaptive management strategies	▪ Number of adaptive strategies implemented in the region and interregionally ▪ Number and diversity of stakeholders participating in regional discussion forums, such as the Sierra Water Work Group
Goal 7: Promote equitable distribution of resources to disadvantaged communities and Tribes across the region	
Objectives	
7.1 Support DAC and Tribal project development/ implementation activities by providing ongoing outreach, proposal and funding development assistance, and training	▪ Number of projects developed or implemented ▪ Number and diversity of people reached ▪ Number and diversity of outreach materials developed ▪ Number of trainings conducted ▪ Number of collaboratively developed plans, studies, and assessments ▪ Number of planning efforts resulting in project implementation
7.2 Prioritize ongoing participation of DACs and Tribes in the Regional Water Management Group	▪ Number and diversity of people reached ▪ Number of projects developed or implemented ▪ Number of DACs and Tribes actively participating on the RWMG ▪ Number and diversity of outreach materials developed
7.3 Foster partnerships to build the capacity of DACs and Tribes throughout the region to manage their own recreational amenities	▪ Number of projects developed or implemented ▪ Number and diversity of people reached ▪ Number and diversity of outreach materials developed ▪ Number of collaboratively developed plans and assessments ▪ Number of planning efforts resulting in project implementation ▪ Number of trainings conducted
7.4 Promote regional education and outreach in collaboration with DACs and Tribes	▪ Number and diversity of people reached ▪ Number and diversity of outreach materials developed ▪ Number of trainings conducted

Chapter 13 *Resource Management Strategies*

13.0 Introduction

This chapter: 1) defines Resource Management Strategies (RMSs), 2) documents the range of state RMSs considered to meet IRWMP objectives, 3) provides a rationale for which of the state's RMSs are applicable to the region, 4) articulates which applicable RMSs address the region's identified climate change vulnerabilities, and 5) demonstrates how RMSs are integrated into the project development process.

13.1 Defining Resource Management Strategies

A resource management strategy is a project, program, or policy that helps local and regional agencies and governments manage water and watershed resources. RMSs are key components of the California Water Plan Update (2009). The range of strategies is comprehensive. These diverse tools are designed to meet the resource management needs of each region and the state. Therefore, not all RMSs apply to each IRWM region. The combination of RMSs varies depending on distinctive features of a region—its geography, climate, water system, and watershed attributes, in addition to its land-use patterns and social conditions.

13.2 California Water Plan Resource Management Strategies

The intended purpose of RMSs is to encourage diverse approaches to solve water management issues as a means to mitigate for uncertain future circumstances and comply with Public Resource Code (PRC) Section 75026 and California Water Code Section 10541(e)(2) (DWR 2010). **Table 13-1** below lists all 29 state RMSs as represented in the California Water Plan Update (2009) and their corresponding management objectives. During the development of the Yuba County IRWMP Update, the California Water Plan Update (2013) also occurred. At the time of developing this IRWMP, the Public Review Draft of the Water Plan Update was made available with some additions to the state RMSs. While this document does not directly incorporate the new RMSs, upon review, new state RMSs, such as Water and Culture and Outreach and Engagement are strategies that the region is already employing through existing collaborative efforts, expanded outreach through the IRWMP Update, and through project development and integration efforts.

Table 13-1. State of California RMSs and Management Objectives[1]		
	RMS	**Management Objective**
1	Agricultural Lands Stewardship	Practice Resource Stewardship
2	Agricultural Water Use Efficiency	Reduce Water Demand
3	Conjunctive Management and Groundwater Storage	Increase Water Supply
4	Conveyance - Delta	Improve Operational Efficiency and Transfers of Water
5	Conveyance - Regional/Local	Improve Operational Efficiency and Transfers of Water
6	Crop Idling for Water Transfers	Improve Operational Efficiency and Transfers of Water
7	Desalination	Increase Water Supply
8	Drinking Water Treatment and Distribution	Improve Water Quality
9	Economic Incentives	Practice Resource Stewardship
10	Ecosystem Restoration	Practice Resource Stewardship
11	Flood Risk Management	Improve Flood Management
12	Forest Management	Practice Resource Stewardship
13	Groundwater Remediation/Aquifer Remediation	Improve Water Quality
14	Land Use Planning and Management	Practice Resource Stewardship
15	Matching Water Quality to Use	Improve Water Quality
16	Pollution Prevention	Improve Water Quality
17	Precipitation Enhancement	Increase Water Supply
18	Recharge Area Protection	Practice Resource Stewardship
19	Recycled Municipal Water	Increase Water Supply
20	Salt and Salinity Management	Improve Water Quality
21	Surface Storage - CALFED	Increase Water Supply
22	Surface Storage - Regional/Local	Increase Water Supply
23	System Reoperation	Improve Operational Efficiency and Transfers of Water
24	Urban Run-off Management	Improve Water Quality
25	Urban Water Use Efficiency	Reduce Water Demand
26	Water Transfers	Improve Operational Efficiency and Transfers of Water
27	Water-dependent Recreation	Practice Resource Stewardship
28	Watershed Management	Practice Resource Stewardship
29	Other Strategies such as Irrigated Land Retirement	Objectives Vary by Strategy

13.3 Documenting the Process for RMS Determination

The Yuba County IRWM region initiated the RMS determination process for the IRWMP Update by first identifying regional issues and conflicts which informed the development of goals and objectives. With the goals and objectives in place, the Regional Water Management Group (RWMG), the Yuba County IRWM region's governing body, considered the full range of RMSs found in the California Water Plan. They explored which RMSs were applicable to achieve the goals and objectives of the IRWMP. This sequence was undertaken to reinforce that RMSs are tools to address regional issues and meet multiple objectives. **Table 13-2** below illustrates the relationship between the Yuba County regionally identified goals and objectives and the corresponding, applicable RMS.

[1] State of California, Water Plan Update Volume 2 Resource Management Strategies, pp 1-6 (2009).

Table 13-2. The Relationship Between Goals and Objectives and RMSs	
Goals/Objectives	**RMSs**
Goal 1: Ensure adequate and reliable water supply that meets the diverse needs of the region	
1.1 Improve water supply system capacity, flexibility, and efficiency, including, but not limited to, optimizing existing water storage, upgrading and retrofitting aging infrastructure, and developing new infrastructure, where necessary.	▪ Agricultural Water Use Efficiency ▪ Conjunctive Management and Groundwater Storage ▪ Conveyance Delta ▪ Conveyance Local/Regional ▪ Drinking Water Treatment and Distribution ▪ Economic Incentives ▪ Matching Quality to Use ▪ Pollution Prevention ▪ Recharge Area Protection ▪ Recycled Municipal Water ▪ Surface Storage Regional/Local ▪ System Reoperation ▪ Urban Run-off Management ▪ Urban Water Use Efficiency ▪ Water Transfers
1.2 Promote water conservation and water use efficiency by instituting various techniques including, but not limited to, groundwater recharge, conjunctive management, irrigation efficiencies, municipal water conservation, water recycling and reuse.	▪ Agricultural Lands Stewardship ▪ Agricultural Water Use Efficiency ▪ Conjunctive Management and Groundwater Storage ▪ Conveyance Regional/Local ▪ Drinking Water Treatment and Distribution ▪ Economic Incentives ▪ Ecosystem Restoration ▪ Irrigated Land Retirement ▪ Land Use Planning and Management ▪ Matching Quality to Use ▪ Pollution Prevention ▪ Recharge Area Protection ▪ Recycled Municipal Water ▪ Salt and Salinity Management ▪ Urban Runoff Management ▪ Urban Water Use Efficiency ▪ Water Transfers
1.3 Protect and restore water supplies that support wildlife species and watershed health.	▪ Agricultural Lands Stewardship ▪ Conjunctive Management and Groundwater ▪ Conveyance Local/Regional ▪ Economic Incentives ▪ Ecosystem Restoration ▪ Forest Management ▪ Irrigated Land Retirement ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Recharge Area Protection ▪ System Reoperation ▪ Urban Runoff Management ▪ Water-Dependent Recreation ▪ Watershed Management ▪ Water Transfers

1.4 Promote disaster preparedness and conservation planning efforts.	▪ Agricultural Lands Stewardship ▪ Agricultural Water Use Efficiency ▪ Conjunctive Management and Groundwater Storage ▪ Conveyance Regional/Local ▪ Drinking Water Treatment and Distribution ▪ Economic Incentives ▪ Flood Risk Management ▪ Forest Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Recycled Municipal Water ▪ Salt and Salinity Management ▪ Surface Storage Regional/Local ▪ System Reoperation ▪ Urban Runoff Management ▪ Urban Water Use Efficiency ▪ Watershed Management ▪ Water Transfers
1.5 Maintain and enhance flood control infrastructure to protect water supplies.	▪ Agricultural Lands Stewardship ▪ Conveyance Regional/Local ▪ Flood Risk Management ▪ Land Use Planning and Management ▪ Surface Storage Regional/Local ▪ System Reoperation ▪ Urban Run-off Management ▪ Water Transfers
1.6 Preserve water supplies that support recreational opportunities, ecosystem services, and agricultural uses.	▪ Agricultural Lands Stewardship ▪ Economic Incentives ▪ Ecosystem Restoration ▪ Forest Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Recharge Area Protection ▪ Recycled Municipal Water ▪ System Reoperation ▪ Urban Run-off Management ▪ Water Transfers ▪ Water-Dependent Recreation ▪ Watershed Management
1.7 Support regulatory compliance with current and future state and federal water supply standards.	▪ Agricultural Water Use Efficiency ▪ Conveyance Regional/Local ▪ Drinking Water Treatment and Distribution ▪ Economic Incentives ▪ Land Use Planning and Management ▪ Recharge Area Protection ▪ Surface Storage Regional/Local ▪ System Reoperation ▪ Urban Water Use Efficiency ▪ Water Transfers
1.8 Promote regional education and outreach regarding water supply issues and needs.	▪ Agricultural Lands Stewardship ▪ Agricultural Water Use Efficiency ▪ Drinking Water Treatment and Distribution

1.8 *continued*	▪ Economic Incentives ▪ Ecosystem Restoration ▪ Forest Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Urban Run-off Management ▪ Urban Water Use Efficiency ▪ Water-Dependent Recreation ▪ Watershed Management
Goal 2: Protect, restore, and enhance water quality for water users and in support of healthy watersheds	
2.1 Protect and improve water quality by mitigating for urban, agricultural, and wildland/sediment run-off.	▪ Agricultural Lands Stewardship ▪ Agricultural Water Use Efficiency ▪ Conjunctive Management and Groundwater Storage ▪ Conveyance Regional/Local ▪ Drinking Water Treatment and Distribution ▪ Forest Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Urban Run-off Management ▪ Urban Water Use Efficiency ▪ Watershed Management
2.2 Minimize water quality impacts from flood, effluent discharge, and wastewater spills.	▪ Economic Incentives ▪ Flood Risk Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Urban Run-off Management
2.3 Promote recreational activities and programs that minimize or mitigate impacts to water quality.	▪ Agricultural Lands Stewardship ▪ Ecosystem Restoration ▪ Forest Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Urban Run-off Management ▪ Water-Dependent Recreation ▪ Watershed Management
2.4 Protect and improve the water quality of water generated by healthy, forested watersheds.	▪ Agricultural Lands Stewardship ▪ Ecosystem Restoration ▪ Forest Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Urban Run-off Management ▪ Watershed Management
2.5 Maintain and improve water quality required to restore and protect freshwater ecosystems, fisheries, and groundwater-dependent habitat.	▪ Agricultural Lands Stewardship ▪ Agricultural Water Use Efficiency ▪ Conjunctive Management and Groundwater Storage ▪ Conveyance Regional/Local ▪ Economic Incentives ▪ Ecosystem Restoration ▪ Forest Management ▪ Pollution Prevention ▪ System Reoperation ▪ Urban Run-off Management

2.5 *continued*	▪ Urban Water Use Efficiency ▪ Watershed Management
2.6 Support regulatory compliance with current and future state and federal water quality standards.	▪ Agricultural Lands Stewardship ▪ Drinking Water Treatment and Distribution ▪ Economic Incentives ▪ Forest Management ▪ Groundwater/Aquifer Remediation ▪ Matching Quality to Use ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Salt and Salinity Management ▪ System Reoperation ▪ Urban Run-off Management ▪ Watershed Management
2.7 Protect public and ecosystem health from the physical and chemical hazards of Abandoned Mine Lands (AMLs).	▪ Ecosystem Restoration ▪ Pollution Prevention ▪ Forest Management ▪ Watershed Management
Goal 3: Preserve and restore watershed health and promote environmental stewardship	
3.1 Steward healthy forests through fire and fuels management, erosion control measures, and wetland restoration.	▪ Agricultural Lands Stewardship ▪ Ecosystem Restoration ▪ Forest Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Watershed Management
3.2 Identify and manage for aquatic and terrestrial invasive species and their impact on water supply infrastructure and watershed health.	▪ Agricultural Lands Stewardship ▪ Conveyance Regional/Local ▪ Ecosystem Restoration ▪ Forest Management ▪ Storage Local/Regional ▪ Watershed Management
3.3 Recover endangered and threatened fish species through habitat restoration and by addressing access to historic habitat, wherever feasible.	▪ Conveyance Regional/Local ▪ Economic Incentives ▪ Ecosystem Restoration ▪ Forest Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ System Reoperation ▪ Watershed Management
3.4 Enhance floodplain function and wildlife habitat while achieving multiple flood management benefits and maintaining public safety.	▪ Agricultural Lands Stewardship ▪ Ecosystem Restoration ▪ Flood Risk Management ▪ Forest Management ▪ Irrigated Land Retirement ▪ Land Use Planning and Management ▪ Recharge Area Protection ▪ System Reoperation ▪ Watershed Management
3.5 Promote watershed-level remediation of legacy mining toxins.	▪ Ecosystem Restoration ▪ Forest Management ▪ Pollution Prevention

3.5 *continued*	▪ Watershed Management
3.6 Support environmental protections to prevent the extinction of economically, ecologically, and culturally significant species.	▪ Economic Incentives ▪ Ecosystem Restoration ▪ Forest Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Recharge Area Protection ▪ System Reoperation ▪ Watershed Management
3.7 Steward the region's biodiversity and ecological resources that directly provide opportunities for public access, recreation, and education while maintaining the co-equal objectives of flood protection and preservation of agricultural lands.	▪ Economic Incentives ▪ Ecosystem Restoration ▪ Forest Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Water-Dependent Recreation ▪ Watershed Management
Goal 4: Enhance regional economic development by supporting recreational opportunities and sustainable agriculture	
4.1 Promote comprehensive recreation planning and implementation with a focus on regional economic development.	▪ Agricultural Lands Stewardship ▪ Forest Management ▪ Land Use Planning and Management ▪ Water-Dependent Recreation ▪ Watershed Management
4.2 Enhance river access points to encourage recreational use while preserving flood control/water storage infrastructure and managing for human impacts to watershed health.	▪ Agricultural Lands Stewardship ▪ Land Use Planning and Management ▪ Water-Dependent Recreation ▪ Watershed Management
4.3 Create river corridor linkages while enhancing migration corridors for plants and animals.	▪ Agricultural Lands Stewardship ▪ Economic Incentives ▪ Ecosystem Restoration ▪ Forest Management ▪ Land Use Planning and Management ▪ Water-Dependent Recreation ▪ Watershed Management
4.4 Explore opportunities to increase water-dependent tourism throughout the region while building local communities' capacity to manage their recreational resources.	▪ Agricultural Lands Stewardship ▪ Ecosystem Restoration ▪ Forest Management ▪ Land Use Planning and Management ▪ Water-Dependent Recreation ▪ Watershed Management
4.5 Protect and restore working landscapes, particularly ranch/ag lands, and the watershed benefits they provide.	▪ Agricultural Lands Stewardship ▪ Agricultural Water Use Efficiency ▪ Conjunctive Management and Groundwater Storage ▪ Conveyance Regional/Local ▪ Economic Incentives ▪ Ecosystem Restoration ▪ Flood Risk Management ▪ Forest Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Salt and Salinity Management ▪ Watershed Management

4.6 Promote regulations that support local and regional economic resiliency by working with and among regulatory agencies to: 1) reduce regulatory conflicts, 2) ensure consistent enforcement of regulations, and 3) reduce costs and difficulty of meeting regulatory compliance.	▪ Agricultural Lands Stewardship ▪ Conjunctive Management and Groundwater Storage ▪ Economic Incentives ▪ Forest Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Recharge Area Protection ▪ Urban Run-off Management ▪ Urban Water Use Efficiency ▪ Watershed Management
Goal 5: Protect public safety through emergency and drought preparedness and integrated flood management	
5.1 Improve integrated flood management to ensure emergency preparedness, increase flood protection, and enhance regional and interregional collaboration.	▪ Conveyance Regional/Local ▪ Economic Incentives ▪ Ecosystem Restoration ▪ Flood Risk Management ▪ Forest Management ▪ Irrigated Land Retirement ▪ Land Use Planning and Management ▪ Recharge Area Protection ▪ System Reoperation ▪ Urban Run-off Management ▪ Watershed Management
5.2 Support regional and interregional collaboration to improve drought and emergency preparedness.	▪ Agricultural Water Use Efficiency ▪ Conjunctive Management and Groundwater Storage ▪ Conveyance Delta ▪ Conveyance Regional/Local ▪ Drinking Water Treatment and Distribution ▪ Economic Incentives ▪ Flood Risk Management ▪ Forest Management ▪ Irrigated Land Retirement ▪ Land Use Planning and Management ▪ Storage Local/Regional ▪ System Reoperation ▪ Urban Run-off Management ▪ Urban Water Use Efficiency ▪ Water Transfers ▪ Watershed Management
Goal 6: Address climate vulnerabilities and reduce greenhouse gas emissions	
6.1 Support efforts to reduce greenhouse gas emissions in the region, particularly those directly related to water management operations.	▪ Agricultural Water Use Efficiency ▪ Conjunctive Management and Groundwater Storage ▪ Ecosystem Restoration ▪ Forest Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ System Reoperation ▪ Urban Water Use Efficiency ▪ Watershed Management

6.2 Improve data modeling and technical analyses to better understand the impacts of climate change on regional and interregional water supply and watershed health.	▪ Conjunctive Management and Groundwater Storage ▪ Flood Risk Management ▪ Forest Management ▪ Land Use Planning and Management ▪ Recharge Area Protection ▪ System Reoperation ▪ Watershed Management
6.3 Increase system flexibility and resiliency to adapt to climate variability.	▪ Agricultural Water Use Efficiency ▪ Conjunctive Management/Groundwater Storage ▪ Conveyance Regional/Local ▪ Drinking Water Treatment and Distribution ▪ Ecosystem Restoration ▪ Flood Risk Management ▪ Forest Management ▪ Land Use Planning and Management ▪ Recycled Municipal Water ▪ System Reoperation ▪ Urban Water Use Efficiency ▪ Water Transfers ▪ Watershed Management
6.4 Promote alternative energy and energy efficiency throughout the region.	▪ Agricultural Water Use Efficiency ▪ Economic Incentives ▪ Ecosystem Restoration ▪ Forest Management ▪ Land Use Planning and Management ▪ System Reoperation ▪ Urban Water Use Efficiency ▪ Watershed Management
6.5 Promote education about climate change and its impacts on water management and watershed health throughout the region.	▪ Agricultural Water Use Efficiency ▪ Agricultural Lands Stewardship ▪ Drinking Water Distribution and Treatment ▪ Ecosystem Restoration ▪ Flood Risk Management ▪ Forest Management ▪ Land Use Planning and Management ▪ Recycled Municipal Water ▪ System Reoperation ▪ Urban Water Use Efficiency ▪ Water-Dependent Recreation ▪ Watershed Management
6.6 Promote regional and interregional collaborations to implement climate change adaptive management strategies.	▪ Agricultural Lands Stewardship ▪ Agricultural Water Use Efficiency ▪ Conjunctive Management/Groundwater Storage ▪ Economic Incentives ▪ Ecosystem Restoration ▪ Flood Risk Management ▪ Forest Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Recharge Area Protection ▪ Urban Water Use Efficiency ▪ System Reoperation

6.6 *continued*	▪ Urban Water use Efficiency ▪ Water Transfers ▪ Watershed Management
Goal 7: Promote equitable distribution of resources to disadvantaged communities and Tribes across the region	
7.1 Support DAC and Tribal project development/ implementation activities by providing ongoing outreach, proposal and funding development assistance, and training.	▪ Agricultural Water Use Efficiency ▪ Conjunctive Management and Groundwater Storage ▪ Drinking Water Treatment and Distribution ▪ Economic Incentives ▪ Ecosystem Restoration ▪ Flood Risk Management ▪ Forest Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Recycled Municipal Water ▪ Urban Run-off Management ▪ Urban Water Use Efficiency ▪ Water-Dependent Recreation ▪ Watershed Management
7.2 Prioritize ongoing participation of DACs and Tribes in the Regional Water Management Group	▪ Economic Incentives
7.3 Foster partnerships to build the capacity of DACs and Tribes throughout the region to manage their own recreational amenities.	▪ Agricultural Lands Stewardship ▪ Conjunctive Management ▪ Economic Incentives ▪ Ecosystem Restoration ▪ Flood Risk Management ▪ Forest Management ▪ Land Use Planning and Management ▪ Water-Dependent Recreation ▪ Watershed Management
7.4 Promote regional education and outreach in collaboration with DACs and Tribes.	▪ Agricultural Lands Stewardship ▪ Agricultural Water Use Efficiency ▪ Conjunctive Management ▪ Drinking Water Treatment and Distribution ▪ Economic Incentives ▪ Ecosystem Restoration ▪ Flood Risk Management ▪ Forest Management ▪ Land Use Planning and Management ▪ Recycled Municipal Water ▪ Urban Water Use Efficiency ▪ Watershed Management

13.3.1 Rationale for RMS Determination

Table 13-3 below illustrates the RMSs that were identified by the RWMG as applicable to the region. A rationale for each RMS determined as "not applicable to the region" is included in the table. The mix of 27 RMSs displayed in **Table 13-3** demonstrates the breadth of potential water management tools available to Yuba County IRWM region stakeholders.

The RMS structure will be used by the RWMG into the future to support Plan updates in response to ongoing and new studies and policies, development of new data, and new issues that emerge. Future Plan updates will consider whether strategies identified as "not applicable" in this IRWMP Update may become applicable in response to changing conditions. Additionally, in subsequent updates, the RWMG will formally consider new RMSs as identified through the 2013 California Water Plan Update when that document is adopted.

Table 13-3. Resource Management Strategies Applicable to the Yuba County IRWM Region		
State RMS (DWR 2012 Guidelines) (Applicable RMSs are numbered)	**RMSs Applicable to Yuba Region**	**Rationale for Determination**
Reduce Water Demand		
1. Agricultural Water Use Efficiency	Yes	Agriculture is the single largest land use in the Yuba County IRWM region (over 50 percent). The sector is also the largest water user in the region (80 percent), mostly for irrigated crops. Water use efficiency is already being practiced by water purveyors in the region and on-farm. Efficiency improvements in on-farm irrigation equipment, crop and farm management, and water supply management and distribution systems to reduce water demand will continue to be key considerations in the Yuba County IRWM region.
2. Urban Water Use Efficiency	Yes	Urban water purveyors in the Yuba County IRWM region have estimated, and are on track to comply with, their 2020 targets outlined in their Urban Water Management Plans and required by legislation. Additionally, several Yuba County DACs have elected to employ practices consistent with the 20x2020 targets despite the fact that they are not technically subject to the legislation. In light of climate change and drought conditions, this strategy will continue to be a key consideration to reduce the water demand of residential, commercial, industrial, and institutional water users.
Improve Operational Efficiency and Transfers		
3. Conveyance – Delta	Yes	YCWA currently is party to a water purchase agreement in cooperation with state and federal water project operations which transfers water south of Delta for statewide uses, making it subject to Delta conveyance plans.
4. Conveyance – Regional/ Local	Yes	While the Yuba County IRWM region is one of the smallest IRWM region's in the state, it houses significant local and regional conveyance facilities, most notably YCWA's Yuba River Development Project (FERC No. 2246). Managing the region's conveyance system will continue to be a central priority to specifically address maintenance and improvements of aging infrastructure, impacts to fish and habitat, as well as flooding impacts and levee maintenance.
5. System Reoperation	Yes	The FERC-licensed facilities in the region will require ongoing consideration of this issue. Reoperation to address specific needs, to improve efficiency and water supply reliability as well as reoperation in anticipation of future climate-related changes are all key considerations for the Yuba County IRWM region.
6. Water Transfers	Yes	Water is transferred in the region through interbasin transfers and YCWA conducts water transfers south of Delta as stated in #3. This strategy will continue to be employed in the region. Additionally, it is a key consideration for regional drought preparedness as it allows for coordinated regional response to both short-term and climate-change supply issues.
Increase Water Supply		
7. Conjunctive Management and Groundwater Storage	Yes	Conjunctive management is an established and integrated management strategy of the Lower Yuba River Accord. Also, YCWA and local irrigation districts have established a comprehensive groundwater management program. It will continue to constitute a key consideration in the region. Additionally, regional reliance upon groundwater is substantial, as all five urban water purveyors in the region rely solely on groundwater for municipal use. This reliance could increase given projected climate change trends, further prioritizing this strategy for the region.

Desalination	Not applicable	Not applicable because of distance from coastal zone.
Precipitation Enhancement	Not applicable	Currently cloud seeding is not applied in the region.
8. Recycled Municipal Water	Yes	While recycled water has generally not been used in the Yuba County IRWM region, some water purveyors in the region are considering assessing potential benefits of establishing a program.
9. Surface Storage – CALFED/ State	Not applicable	This RMS is not applicable to the region.
10. Surface Storage – Regional/Local	Yes	Surface storage is actively used as a resource management strategy in the region for water supply, flood control, and hydropower generation. Ongoing dialogue will take place regarding enhanced surface storage options in light of projected climate-change impacts.
Improve Water Quality		
11. Drinking Water Treatment and Distribution	Yes	Evolving drinking water quality standards (regulations) and new technology will keep this strategy relevant, as will the ability of regional DACs to meet these water quality standards. Distribution system efficiencies and upgrades are a key concern.
12. Groundwater Remediation/Aquifer Remediation	Yes	While groundwater remediation is not currently being utilized as an RMS, there are some undocumented cases of groundwater contamination. Also, there is some concern about possible groundwater contamination that may occur if a proposed landfill is developed in the City of Wheatland.
13. Matching Quality to Use	Yes	YCWA's conjunctive management program and the Lower Yuba River Accord actively match quality of water to the respective uses. Municipal water purveyors in the region are considering recycled water programs that would match quality to use. However, the costs associated with infrastructure are a key concern in realizing the potential of this resource management strategy throughout the region.
14. Pollution Prevention	Yes	There are several Clean Water Act Section 303(d)-listed water bodies in the Yuba County IRWM region for pollutants/stressors including pH, mercury, arsenic, temperature, chlorpyrifos, copper, diazinon, Group A pesticides, and BCPs. In addition to the aforementioned pollutants and stressors, sedimentation and ongoing monitoring are issues that are an active focus and will need to be addressed through Plan implementation.
15. Salt and Salinity Management	Not currently applicable	No documented impacts of salt or salinity have been reported in the region. However, with a potential increase in water recycling programs, salt and salinity management may become a more relevant RMS for the region in the future.
16. Urban Runoff Management	Yes	Yuba County is projected to grow substantially within the time horizon of this Plan. Increased development can impact water quality both from a greater level of disturbance and general traffic, and from runoff from constructed surfaces and roads. Moreover, if the climate dries, as projected, less water will be available for dilution of pollutants. The Yuba County IRWM region stakeholders are interested in programs that consider the link between natural resource management and protection of the region's water quality.
Improve Flood Management		
17. Flood Risk Management	Yes	Flooding and flood management have been identified as major issues by stakeholders in the Yuba County IRWM region, especially in the Central Valley where most of the region's population resides, and agricultural production is vulnerable. Flooding has been a recurrent and often extensive occurrence that has had significant social and economic impacts. Integrated flood management, disaster mitigation and flood plans, and projects that prioritize flood control

		and floodplain restoration to attenuate flooding will continue to be priority strategies for the Yuba County IRWM region.
Practice Resources Stewardship		
18. Agricultural Lands Stewardship	Yes	As previously stated, agricultural land use is the largest single land use in the planning area, both the irrigated agricultural and grazing/pasture operations and lands in the region are key to the local economy and open space values. Ongoing strategies include on-farm BMPs, potential for carbon sequestration on pasture lands, and working to identify crops that are appropriate to climate change considerations. Agricultural lands constitute an integral feature of flood management to the region and will continue to function as an essential flood control strategy.
19. Economic incentives (Loans, Grants, and Water Pricing)	Yes	Water-pricing incentives are already in use in the region and will continue to play a role, particularly in response to impacts of supply due to climate change.
20. Ecosystem Restoration	Yes	Yuba County IRWM regional stakeholders are engaged in ongoing ecosystem restoration activities, including floodplain restoration, riparian reforestation, habitat restoration for salmonids and other in-stream biota, vernal pool restoration, remediation of mining toxins, and fire and fuels management for forest health. These restoration activities will continue to constitute key strategies for the region.
21. Forest Management	Yes	In the upper watershed and in the areas around New Bullards Bar Reservoir, there are federally owned or privately managed forest lands. Study of the impacts of a variety of management strategies and pilot projects is already ongoing and will continue. A key evaluation of climate change is focused on the impacts of catastrophic wildfire.
22. Recharge Area Protection	Yes	The 2010 Yuba County Water Agency Groundwater Management Plan suggests that runoff and recharge from agricultural irrigation may be a significant contributor to overall groundwater, offering over 30 percent of recharge from percolation of applied surface water. Yuba County population growth projections indicate that a significant percentage of agricultural lands in the county will be urbanized. This future condition may pose a threat to groundwater recharge in the region and highlight the need to protect these recharge areas.
23. Water-Dependent Recreation	Yes	Water-dependent recreation is an economic driver for the region. Many stakeholders have voiced interest in expanding water-dependent recreation to enhance the regional economy through project implementation. Balancing the expansion of water-dependent recreation and human impacts to watershed health, public safety, and flood management will be key considerations.
24. Watershed Management	Yes	Issues associated with watershed management are of central importance to stakeholders in the Yuba County IRWM region. Stewardship of watershed lands will continue to be reflected in IRWMP projects and inter-IRWMP coordination activities.
Other Strategies		
25. Crop Idling for Water Transfers	Not currently applicable	In light of climate-change projections of climate drying and more precipitation and less snowmelt, this management strategy, while currently not in use, may be considered in the future to enhance water supply reliability, enhance water quality, and protect and restore fish and wildlife resources. While this strategy is not currently employed, the Yuba County Board of Supervisors made the determination that crop idling could not be used as a strategy to facilitate water transfers outside of the Yuba County IRWM region.

26. Irrigated Land Retirement	Yes	In light of climate change projections of climate drying and more precipitation and less snowmelt, this management strategy may be considered to enhance water supply reliability, enhance water quality, and protect and restore fish and wildlife resources.
27. Land Use Planning and Management	Yes	The Yuba County Planning and Community Services division is actively engaged in the Yuba County IRWMP Update. Land use planners and water managers will continue to coordinate activities, particularly when considering population growth projections for the region.

13.4 Regional RMSs that Address Climate Change Vulnerabilities

The climate change working group, known as the Core Group, articulated and prioritized regional climate change vulnerabilities and adaptive management strategies, as described in Chapter 11 *Climate Change*. **Table 13-4** identifies applicable regional RMSs that address high-priority climate change vulnerability issues.

Table 13-4. Regional Resource Management Strategies that Address Climate Change Vulnerabilities

Climate Change Vulnerability	Description of Possible Impacts of Vulnerabilities	RMS Addressing Climate Change
Water Supply/Demand	▪ Camptonville and other foothill communities/rural areas currently suffer water shortages ▪ Camptonville's summer user demand and Title 22 requirements exceed the capacities of the water treatment system ▪ Reduced water supply reliability ▪ Agriculture water use may be the most vulnerable to climate change ▪ Environmental flows also will likely be affected by increasing temperatures, erratic rainfall, and earlier snowmelt ▪ Reservoir storage levels decline for the summer months and some lack carryover capacity (>2 years) ▪ Declining snowpack increases the risk of supply uncertainty ▪ Changes will be required for basin-wide management and storage of water, especially for irrigation ▪ Groundwater extraction in reaction to climate change has the potential to affect wetland-dependent, riparian, and aquatic habitats ▪ State water policies and out-of-region demands (e.g., Delta) could affect water supply as much as the impacts from climate change ▪ Increased frequency of water transfers within the context of a finite water supply ▪ Ability to deliver water transfers may be jeopardized ▪ Out-of-region diversions may decrease ▪ State water policies and out-of-region demands (e.g., Sacramento-San Joaquin Delta) could affect water supply management as much as the direct effects of climate change ▪ Climate change-related surface water decreases could increase future groundwater demands and out-of-area transfer demands ▪ Urbanization; changes in technology; and timing of crop planting, development, and harvest could result in altered timing and demand for irrigation water ▪ Conflicts may increase among agricultural, domestic, flood control, hydrogeneration, and environmental water management ▪ Further data is needed to fully manage the region's groundwater	▪ Agricultural Water Use Efficiency ▪ Conjunctive Management and Groundwater Storage ▪ Conveyance Delta ▪ Conveyance Local/Regional ▪ Ecosystem Restoration ▪ Forest Management ▪ Irrigated Lands Retirement ▪ Land Use Planning and Management ▪ Matching Quality to Use ▪ Recharge Area Protection ▪ Recycled Municipal Water ▪ Surface Storage Regional/Local ▪ System Reoperation ▪ Urban Water Use Efficiency ▪ Water Transfers ▪ Watershed Management

Water Quality	▪ Camptonville's water quality suffers during heavy rain events, requiring the treatment plant to be shut down due to turbidity ▪ Increased algae could reduce delivery capacity and increase the need for filtering of irrigation infrastructure in localized areas ▪ Peak storm events may increase transport of mercury from stream channels, with related potential for increased methylmercury ▪ Decreased overall supply would likely result in a higher concentration of pollutants ▪ Increased water temperatures may significantly impact aquatic ecosystems ▪ Fluctuating reservoir water levels due to increased climate variability could result in increased sedimentation and reservoir storage and maintenance problems ▪ Removal of vegetation from increased wildfire could result in increased erosion and sedimentation	▪ Ecosystem Restoration ▪ Flood Risk Management ▪ Forest Management ▪ Land Use Planning and Management ▪ Pollution Prevention ▪ Urban Run-off Management ▪ Watershed Management
Infrastructure (water storage and conveyance)	▪ Water storage infrastructure was designed for a historic demand, and may not accommodate increased winter peak flows, or have adequate carryover storage for drought periods ▪ The conveyance system was designed for a certain demand; therefore, inadequate peaking capacity may exist during times of extraordinary heat (for irrigation demand) ▪ Conflicts over storage may increase among agricultural, domestic, hydropower, flood control, and environmental needs	▪ Agricultural Lands Stewardship ▪ Surface Storage Regional/Local ▪ Conveyance Delta ▪ Conveyance Regional/Local ▪ Flood Risk Management ▪ Land Use Planning and Management ▪ System Reoperation ▪ Water Transfers ▪ Watershed Management
Flooding	▪ Increased storm intensity and severity puts communities, critical infrastructure, and protective levees at greater risk ▪ Responses to increased flood risk could impact water delivery for regional demands and hinder YCWA's ability to transfer stored water ▪ Flooding infrastructure was designed for historic flood regimes and to protect substantially less human development, and may increase conflicts/complexity in managing for both storage and flood control	▪ Conveyance Regional/Local ▪ Flood Risk Management ▪ Surface Storage Regional/Local ▪ System Reoperation ▪ Water Transfers ▪ Watershed Management
Species and Habitat	▪ Vegetative communities are expected to move upslope with significant loss of subalpine and alpine vegetation and large increases in hardwoods and grasslands ▪ Climate variation is projected to affect foothill woodland and chaparral vegetation and the rare and unique species they support ▪ Decreases in surface flows may threaten fish and other aquatic life	▪ Conjunctive Management and Groundwater Storage ▪ Conveyance Delta ▪ Conveyance Regional/Local ▪ Ecosystem Restoration ▪ Forest Management ▪ Land Use Planning and Management ▪ Recharge Area Protection ▪ System Reoperation ▪ Watershed Management

Wildfire	▪ Fire risk is projected to rise significantly at higher elevations by 2085 ▪ Local conditions exacerbate future fire risks for Yuba County ▪ Research has identified high fire hazards in even-aged silvicultural systems (clear-cut conifer plantations) such as those located north and east of New Bullards Bar Reservoir	▪ Ecosystem Restoration ▪ Forest Management ▪ Land Use Planning and Management ▪ Watershed Management
Socioeconomics	<u>Public Health and Safety</u> ▪ Increased potential for flood risk could result in human and economic losses ▪ Flooding and heat waves may have the greatest effects on disadvantaged/under-represented communities ▪ The northern two-thirds of the county's critical facilities are exposed to fire-threat hazard ▪ Residential development is taking place in fire-adapted vegetation, increasing potential for human and economic loss ▪ Increased fire-threat hazards will increase fire management costs <u>Agriculture</u> ▪ Greater evapotranspiration may lead to conditions less suitable for traditional crop types ▪ Heat-sensitive crops and livestock likely will be vulnerable to prolonged high temperatures ▪ Lost revenues from climate-related events will potentially negatively affect regional income, employment, and tax revenues ▪ Water deficits could hasten conversion of agricultural land to urban uses <u>Hydropower Production</u> ▪ Climate impacts on high-elevation hydropower production would have wide-ranging effects ▪ Climate adaptation will likely require a combination of operating changes to hydrogeneration facilities, with related secondary impacts to water facilities and delivery; even so, generation losses are probable ▪ Revenue losses from hydropower are projected. Decreased hydropower production coupled with increased summer energy demands could affect the local economy <u>Recreation</u> ▪ Recreational pursuits and tourism could be affected by low flows ▪ Projected low flows may not be sufficient to sustain FERC-licensed rafting flows, having secondary negative effects on the local economy ▪ Recreational forest resources are likely to be affected by changes in flow regime	▪ Agricultural Lands Stewardship ▪ Agricultural Water Use Efficiency ▪ Conjunctive Management and Groundwater Storage ▪ Conveyance Regional/Local ▪ Economic Incentives ▪ Ecosystem Restoration ▪ Flood Risk Management ▪ Forest Management ▪ Land Use Planning and Management ▪ Surface Storage Regional/Local ▪ System Reoperation ▪ Water-Dependent Restoration ▪ Watershed Management

	Timber Harvest ▪ Potential climatic changes are expected to affect type, location, and amount of timber inventories, but may generate need for alternative timber management/ production and fuels reduction project	

13.5 Integrating RMSs into Project Application, Development, and Review

RMSs were integrated into all aspects of project application, development, and review. The RMS framework was used extensively to ensure a linkage between issues, RMSs, goals and objectives, adaptive management strategies, and individual project development.

The Yuba County IRWMP application form (*Project Solicitation Form)* included an RMS section requiring project sponsors to indicate which applicable state RMSs were employed by the proposed projects. The project proponents were further asked to provide a brief explanation of how the projects incorporated the named RMSs. Following the initial application, the project team collaborated with each project sponsor to refine their strategies, ensuring that each project considered the full range of applicable RMSs and applied the appropriate tools or strategies to the development of their projects. Finally, RMSs constitute one of the nine criteria used to review projects for IRWMP inclusion. In the Project Review Criteria, Project Integration and Multiple Resource Management Strategies are combined to form one criterion. Please Refer to Chapter 14 *Project Application, Development, and Review* for more information.

Chapter 14 *Project Application, Development, and Review*

14.0 Introduction

This chapter describes the processes by which projects implementing this Plan are identified, developed, reviewed, and selected for Plan inclusion.

14.1 Project Application Process

The project application process followed the initial identification of regional issues and conflicts as well as goals and objectives and resource management strategies, as described in sections 12.4 Integration of Issues, Goals, and Objectives into Project Development Process and 13.5 Integrating Resource Management Strategies into Project Application, Development, and Review. This sequenced approach makes it possible for project sponsors to demonstrate through the application process how their proposed projects would implement key elements of the IRWMP, as well as avoid project impacts and maximize project benefits. It also allows for strategic considerations for Plan implementation (e.g., integrating projects, project alternatives).

The formal project application process for this update began following the establishment of the foundational components of the planning process listed above. The project applications (referred to as the Project Solicitation Form) were distributed by the project team via the stakeholder email distribution list and by posting on the Yuba County IRWMP website. A project development workshop was convened in early November 2013 to: 1) provide an overview of the project development timeline (see **Table 14-1**); 2) review the Project Solicitation Form (see **Appendix 14-2**); 3) allow project proponents the opportunity to briefly present the projects they intended to submit to be considered for Plan inclusion; and 4) discuss project integration opportunities.

Ultimately, 60 project applications were submitted to the Yuba County IRWM region by 15 project sponsors. Over the course of the IRWMP update, additional applications were submitted via email to the Yuba County IRWM group utilizing the application materials described in 14.1.1. In the future, the Yuba County IRWM group intends to issue a periodic call for projects to provide regional stakeholders the opportunity for newly identified projects to be included in the IRWMP. The project applications will be available online, and projects will be accepted for review as they are received.

Table 14-1. Yuba County IRWMP Project Development Process Timeline	
Dates	**Activities**
October 2013	Project sponsors begin to hold independent conversations with other stakeholders in pursuit of forming project partnerships
November 1, 2013	Consulting project team distributes Project Solicitation Form materials to stakeholders via email distribution list and posts form to Yuba County IRWM website
November 7, 2013	Project development and integration workshop
December 13, 2013	Project applications due (for existing and new projects alike, to ensure consistent materials for all projects in the IRWMP)
November 2013 - January 2014	Consulting project team conducts extensive circuit-riding to assist in filling out forms; facilitate integration; brainstorm options for multi-stakeholder, multi-objective projects; gather input on review criteria; and assist in clarifying process for getting projects to 'ready to proceed' status.
January 2014	• Preliminary project list presented to RWMG at meeting • Process for project review identified • Draft project review criteria developed • Partnership confirmation and project integration occurs
April 2014	• Project list finalized • Process for project review criteria refined and approved • Final project descriptions distributed for RWMG review
May 2014	• Cost/benefit questionnaire and greenhouse gas (GHG) inventories completed for projects • Project sponsors make project presentations at RWMG meeting • Project review conducted and projects confirmed for IRWMP inclusion at RWMG meeting
June 2014	• Draft project chapter completed and distributed to RWMG for review
July 2014	• RWMG comments received for draft project development chapter • Project development chapter refined

14.1.1 Project Application Materials

14.1.1.1 The Project Solicitation Form

The Project Solicitation Form (see **Appendix 14-2**) serves as the primary project application for the Yuba IRWM region. The form was developed in accordance with DWR 2012 Guidelines, paying particular attention to A-L Review Factors as outlined in the Plan Standard for project application, review, and selection. Project applicants are required to demonstrate the following:

- how the project addresses the regionally identified issues;
- how the project contributes to the IRWMP goals and objectives;
- how the project measures its outcomes (additional information about project performance measures can be found in Chapter 17 *Plan Performance and Monitoring*);
- how the project is related to resource management strategies;
- how the project meets statewide priorities;
- technical and scientific feasibility of the project;
- specific benefits to critical DAC/Tribal water issues and environmental justice considerations;
- project costs and financing (additional information about project financing can be found in Chapter 15 *Finance*);
- project status and anticipated schedule for implementation;
- contribution of the project in adapting to the effects of climate change; and
- contribution of the project in reducing GHG emissions as compared to project alternatives.

Completed Project Solicitation Forms for all Yuba County IRWMP projects can be found in **Appendix 14-1**.

14.1.1.2 The Economic Feasibility Questionnaire

To demonstrate economic feasibility for projects as required by Review Factor H in the 2012 Guidelines, each project sponsor completed a questionnaire (developed by ECONorthwest, a professional consulting firm) as part of the application process. The Department of Water Resources (DWR) stipulates that as part of the project review process, the economic feasibility of a project should be considered.

According to ECONorthwest, conversations with DWR staff indicate that, under this review standard, the guidelines specify that economic feasibility "be a part of how the region evaluates projects." However, DWR staff further indicated that the department doesn't "want to dictate how regions choose to use the economic information." Further, staff was clear that DWR "won't hold [IRWMPs] to a specific methodology," and specifically, a project-level cost/benefit or cost-effectiveness analysis is not required to satisfy Factor H.[1]

IRWMP groups have had difficulty developing economic feasibility criteria for the early project review process used to bring projects into the IRWMP. These challenges include the following:

- lack of quantifiable information about the project's benefits and costs at the early stage of development while being reviewed for acceptance into the IRWMP;
- lack of resources among project proponents to develop robust information at the level needed to conduct any kind of comprehensive economic analysis; and
- lack of technical sophistication among project proponents to complete a quantified assessment of the economic feasibility of their projects.

With this in mind, ECONorthwest developed a streamlined approach that is simpler than a full cost/benefit or cost-effectiveness analysis to be applied to project-level evaluations as part of the project selection process. Because other factors focus on project costs, the questions in the Project Solicitation Form focus on economic benefits.

The simplified set of criteria, firmly grounded in standard economic practice, is considered to satisfy the Factor H review standard. Specifically, the questions would do the following:

- rely on preliminary information that is readily available to project proponents at a conceptual project design phase;
- emphasize qualitative versus quantitative assessments; and
- help project proponents and IRWMP managers begin to think about strategies to address the more detailed economic analysis required for the Implementation Grant application.

Refer to **Appendix 14-3** for Economic Feasibility Questionnaires for Yuba County IRWMP projects.

14.1.1.3 GHG Emissions Quantification Inventory

In the Project Solicitation Form, project sponsors are asked to describe how each project mitigates for GHG emissions as well as the process by which the project proponents considered GHG emissions reduction among project alternatives. Yuba County IRWM region project sponsors are well aware of the need to reduce the emissions associated with their projects. Refer to the Chapter 11 *Climate Change*, section 11.6.2, for a more in-depth discussion of project alternatives and design considerations to reduce GHG emissions.

[1] ECONorthwest, "Questions to Support Future Evaluation of Cost Benefit of Projects for Project Review Process" (April 25, 2014).

In accordance with DWR guidelines, projects are required to calculate GHG emissions associated with project implementation/construction. All Yuba County IRWMP projects that progressed to a level of readiness that supports a viable GHG quantification completed inventories found in Appendix 14-4.

14.1.2 Updating Existing Projects from the 2008 Yuba County IRWMP

Several projects that had been included in the original Yuba County IRWMP (2008) remain active in the region. However, to assure that the RWMG received consistent information for all projects, the group determined that project sponsors were required to use the newly developed project solicitation materials for new *and* already identified 2008 projects. This requirement is of particular importance since the Project Solicitation Form and complementary documents were designed to be compliant with the DWR 2012 Guidelines. Additionally, in order for all projects to stand on an equal footing in the project review process, the RWMG needs consistent information when applying the project review criteria and when selecting projects for Plan inclusion as well as for emergent funding opportunities.

14.2 Project Review Process

As described in **Table 14-1**, the initial project submission deadline for the Yuba County IRWMP Update was December 13, 2013. Following the submission of projects, the consulting project team assembled the preliminary project list and distributed it to stakeholders in advance of the January 15, 2014, RWMG meeting. At that time, stakeholders had an opportunity to confirm the accuracy of the list and ask any questions pertaining to the identified projects.

Between the January and May RWMG meetings, the consulting team collaborated with individual stakeholders to refine and complete all project application materials and to discuss potential opportunities for project integration and coordination with other project proponents and stakeholders. In addition to individual conference calls and ongoing communication with project sponsors, the consulting team also convened a technical assistance workshop to aid project proponents in the completion of GHG quantification inventories and economic feasibility questionnaires.

Following this refinement process, all project solicitation forms were posted to the Yuba County IRWMP website in advance of the May RWMG meeting, where project sponsors made project presentations to the RWMG and confirmed the list of projects to be included in the Yuba County IRWMP. See **Table 14-2** for a complete list of approved Yuba County IRWMP projects and the project review criteria each project fulfills.

14.2.1 Establishment of a Revised Project Review Criteria

In January 2014, the RWMG studied the project review criteria that had been applied to the original 2008 IRWMP in addition to the project review factors found in the DWR 2012 IRWM Guidelines. Through this process, the region revised the project review criteria. The criteria were finalized and unanimously confirmed at the April 2014 RWMG meeting. The project review criteria were then applied to the project list which was confirmed at the May 2014 RWMG meeting.

14.2.2 A Revised Approach to Project Ranking

Through a consensus decision, the RWMG determined that they would not rank or prioritize projects. It is the view of the group that ranking projects sets up a de facto project selection process for funding purposes. The RWMG confirmed that the role of the IRWMP project review process is to collaboratively develop projects for Plan inclusion (not for funding) that as a complete suite would effectively implement the IRWMP. The RWMG further asserted that ranking would create unnecessary competition and conflict among project proponents. Instead, the RWMG decided that they would apply the project review criteria to all of the projects (including conceptual projects) and, in doing so, work to get as many projects as possible to an enhanced status of readiness. Therefore, an explicit objective of this approach aims to build regional capacity to advance water resources and watershed management projects toward effective implementation of the IRWMP.

Another factor affecting the RWMG's decision to forego project ranking is the region's ongoing interest in diversifying its funding of projects beyond DWR's Implementation Grant programs. By maintaining a list of unranked projects, the region is able to maximize its responsiveness to the specific priorities of different and varied funding programs. In other words, project selection would occur when an appropriate funding opportunity arises. Upon careful review of the requests for proposals or proposal solicitation packages, the projects most suited to the priorities and preferences of distinct funding sources would be selected.

14.2.2.1 Strategic Considerations and Project Integration

The Yuba County RWMG addressed project integration throughout the IRWMP Update project development process. While the projects on the current list have not been integrated, the region determined that project integration could occur when developing a suite of projects in response to a funding request and that the following measures of integration could be employed:

- projects meet multiple Yuba County IRWMP priorities (goals, issues, objectives) and provide multiple benefits;
- project integration within and across like projects employing key resource management strategies;
- geographic integration (within a hydrologic system and across watersheds);
- partnership integration (multiple partners for each project, collaborative in design and implementation, federal/state/local, and government/NGO/private sectors are all represented); and
- integration of outcomes or performance measures.

14.3 Project Selection for Yuba County IRWMP Inclusion

At the May 2014 meeting, Yuba County IRWM region project proponents made project presentations to the RWMG. At that time, stakeholders had an opportunity to ask clarifying questions about the presented projects and to voice any concerns or perceived conflicts associated with the proposed projects. Additionally, the RWMG confirmed each project's alignment with the Yuba County IRWMP's project review criteria to affirm each project's contribution toward the successful implementation of the Plan.

At the close of the project presentations, the RWMG unanimously approved all of the projects for inclusion in the Yuba County IRWMP without exception. The following **Table 14-2** includes the complete list of approved Yuba County IRWMP projects and the project review criteria each project fulfills. For detailed project descriptions, see **Appendix 14-1**.

14.4 Procedures for Communicating Selected Projects

Projects developed through the IRWM process are made available to interested parties via two venues: posting of selected projects and project materials on the Yuba County IRWMP website, and via email to the full distribution list that includes the RWMG and interested stakeholders.

Table 14-2. Yuba County IRWMP Project List and Project Review Criteria

PROJECT OVERVIEW					PROJECT REVIEW CRITERIA								
Code	**Title**	**Sponsor**	**Total Budget**	**PROJECT STATUS**	**Criterion 1** Meets multiple objectives	**Criterion 2** Supports integration/ multiple RMSs	**Criterion 3** Technically and/or scientifically feasible	**Criterion 4** Assists region in adapting to climate change	**Criterion 5** Assists region in reducing GHG emissions	**Criterion 6** Addresses specific benefits to DACs	**Criterion 7** Regional/ Inter-regional benefit(s)	**Criterion 8** Funding match/ DAC waiver	**Criterion 9** Economic feasibility
AR-01	Yuba Gold Fields Integrated Flood Management, Habitat, and Recreation Project	American Rivers	$75M	Concept	X	X		X	X		X		
BYLT-01	Yuba Land Conservation Easements	Bear Yuba Land Trust	$5M	Ready	X	X	X	X	X		X	25% match	X
BYLT-02	Yuba Watershed Forest and Fuels Project	Bear Yuba Land Trust	$1,455,000	Ready	X	X	X	X	X	X	X	25% match	X
CCSD-01	Camptonville Water System Improvement Project (Phase II)	Camptonville Community Service District	$664,300	Ready	X	X	X	X	X	X	X	DAC waiver	X
WTLD-01	Citywide Storm Drain Improvement Project	City of Wheatland	$360,000	Ready	X	X	X	X	X		X	25% match	X
WTLD-02	Dry Creek Levee Improvement Project	City of Wheatland	$6.8M - $16.2M	Ready	X		Feasibility study pending	X			X	25% match	X
WTLD-03	North Stormwater Detention Basin Rehabilitation	City of Wheatland	$300,000	Ready	X	X	X	X			X	25% match	X
WTLD-04	Reclaimed Water Feasibility Study	City of Wheatland	$150,000	Ready	X	X	X	X	X		X	25% match	X
WTLD-05	Stormwater Program Management - Equipment Purchase	City of Wheatland	$590,000	Ready	X		X	X	X		X	25% match	X

Code	Title	Sponsor	Total Budget	PROJECT STATUS	**Criterion 1** Meets multiple objectives	**Criterion 2** Supports integration/ multiple RMSs	**Criterion 3** Technically and/or scientifically feasible	**Criterion 4** Assists region in adapting to climate change	**Criterion 5** Assists region in reducing GHG emissions	**Criterion 6** Addresses specific benefits to DACs	**Criterion 7** Regional/ Inter-regional benefit(s)	**Criterion 8** Funding match/ DAC waiver	**Criterion 9** Economic feasibility
WTLD-06	Wastewater Treatment Plant Improvement	City of Wheatland	$4M	Ready	X	X	X	X	X		X	25% match	X
WTLD-07	Wheatland Water Supply Reliability	City of Wheatland	$425,000	Ready	X	X	X	X	X		X	25% match	X
WTLD-08	Well System Monitoring Rehabilitation	City of Wheatland	$210,000	Ready	X	X	X	X	X		X	25% match	X
MLD—01	Marysville Ring Levee Project	Marysville Levee District	$90.4M	Ready	X	X	X	X		X	X	65% federal 30% local	
NYWD-01	Challenge Water Storage Tank Replacement	North Yuba Water District	$911,500	Ready	X	X	X	X	X	X	X	DAC waiver	
NYWD-02	Dobbins Oregon House Canal Improvement Project	North Yuba Water District	$6,778,000	Ready	X	X	X	X		X	X	DAC waiver	
NYWD-03	Forbestown Ditch Improvement Project	North Yuba Water District	$4,650,000	Ready	X	X	X	X	X	X	X	DAC waiver	X
NYWD-04	Forbestown Water Storage Tank and Pipeline Replacement	North Yuba Water District	$1,269,100	Ready	X	X	X	X	X	X	X	DAC Waiver	
NYWD-05	New York Flat Road Water Transmission Main	North Yuba Water District	$1,556,250	Ready	X	X	X	X	X	X	X	DAC Waiver	
NYWD-06	Rackerby Water Storage Tank Replacement	North Yuba Water District	$911,500	Ready	X	X	X	X	X	X	X	DAC Waiver	X

Code	Title	Sponsor	Total Budget	PROJECT STATUS	**Criterion 1** Meets multiple objectives	**Criterion 2** Supports integration/ multiple RMSs	**Criterion 3** Technically and/or scientifically feasible	**Criterion 4** Assists region in adapting to climate change	**Criterion 5** Assists region in reducing GHG emissions	**Criterion 6** Addresses specific benefits to DACs	**Criterion 7** Regional/ Inter-regional benefit(s)	**Criterion 8** Funding match/ DAC waiver	**Criterion 9** Economic feasibility
OPUD-01	Recycled Water Distribution System	Olivehurst Public Utility District	$3,352,987	Ready	X	X	X	X	X	X	X	DAC Waiver	
OPUD-02	Olivehurst Water Main Replacement	Olivehurst Public Utility District	$2,388,166	Ready	X	X	X	X	X	X	X	DAC Waiver	
RD784-01	Acquisition of Landside Urban Levee Maintenance Corridors	RD 784	$5.5M	Ready	X	X	X	X	X	X	X	DAC Waiver	X
RD784-02	Chestnut Pump Station Reconstruction	RD 784	$2.5M	Ready	X	X	X	X	X	X	X	DAC Waiver	X
RD784-03	Edgewater Detention Basin and Pump Station 5 Improvements	RD 784	$3.5M	Ready	X	X	X	X	X	X	X	DAC Waiver	X
RD784-04	Pump Station 1 Reconstruction	RD 784	$500,000	Ready	X	X	X	X	X	X	X	25% Match	X
RD784-05	Pump Station 2 System Improvement	RD 784	$525,000	Ready	X	X	X	X	X	X	X	DAC Waiver	X
RD784-06	Pump Station 10 Improvements	RD 784	$3.7M	Ready	X	X	X	X	X	X	X	DAC Waiver	X
RD817-01	FSRP LAN29 Critical Repair Project - Right Bank Bear River Set-back Levee	RD 817	$7.8M	Concept	X	X		X			X	Currently pursuing cost share partners	
RD817-02	Dry Creek Levee Feasibility Study	RD 817	$797,000	Ready	X	X	X	X			X	TBD	

Code	Title	Sponsor	Total Budget	PROJECT STATUS	Criterion 1 Meets multiple objectives	Criterion 2 Supports integration/ multiple RMSs	Criterion 3 Technically and/or scientifically feasible	Criterion 4 Assists region in adapting to climate change	Criterion 5 Assists region in reducing GHG emissions	Criterion 6 Addresses specific benefits to DACs	Criterion 7 Regional/ Inter-regional benefit(s)	Criterion 8 Funding match/ DAC waiver	Criterion 9 Economic feasibility
RD2103-01	Bear River and Dry Creek Levee Feasibility Study	RD 2103	$1.2M	Ready	X	X	X	X			X	TBD	
SYRCL-01	Daguerre Point Dam Fish Passage Improvement	South Yuba River Citizens League	$1M	Ready	X	X	X	X	X		X	30% Match	X
SYRCL-02	Water Conservation Education	South Yuba River Citizens League	$40,000	Ready	X	X	X	X	X	X	X	DAC Waiver	X
SYRCL-03	Yuba River Recreation Projects	South Yuba River Citizens League	$400,000	Ready	X	X	X	X	X		X	TBD	X
SYRCL-04	Yuba Salmon Education	South Yuba River Citizens League	$75,000	Ready	X	X	X	X	X		X	27% Match	X
SYRCL-05	Yuba Salmon Habitat Restoration	South Yuba River Citizens League	$1.5M	Ready	X	X	X	X	X		X	31% Match	X
SYRCL-06	Lower Yuba Environmental Flows	South Yuba River Citizens League	$175,000	Ready	X	X	X	X	X		X	34% Match	X
SCRCD-01	Hydrilla Eradication and Canal Lining	Sutter County RCD	$308,200	Ready	X	X	X	X	X	X	X	25% Match	X

Code	Title	Sponsor	Total Budget	PROJECT STATUS	**Criterion 1** Meets multiple objectives	**Criterion 2** Supports integration/ multiple RMSs	**Criterion 3** Technically and/or scientifically feasible	**Criterion 4** Assists region in adapting to climate change	**Criterion 5** Assists region in reducing GHG emissions	**Criterion 6** Addresses specific benefits to DACs	**Criterion 7** Regional/ Inter-regional benefit(s)	**Criterion 8** Funding match/ DAC waiver	**Criterion 9** Economic feasibility
YC-01	Yuba County Airport Drainage Improvements	Yuba County	$3.6M	Ready	X	X	X	X	X	X	X	25% Match	X
YC-02	Linda Drainage Improvements	Yuba County	$5,625,000	Ready	X	X	X	X	X	X	X	DAC Waiver or 25% Match	X
YC-03	Olivehurst Drainage Study	Yuba County	$15M-$20M	Ready	X	X	X	X	X	X	X	DAC Waiver or 25% Match	X
YC-04	Olivehurst Pump Station	Yuba County	$25,000	Ready	X	X	X	X	X	X	X	DAC Waiver	X
YCWA-01	Groundwater Model Project (Phase 2)	Yuba County Water Agency	$750,000	Ready	X	X	X	X	X	X	X	25% Match	X
YCWA-02	Irrigation Water Measurement Implementation	Yuba County Water Agency	$580,700	Ready	X	X	X	X	X		X	25% Match	X
YCWA-03	New Bullards Bar Outlet Capacity Increase	Yuba County Water Agency	$37.23M	Ready	X	X	X	X	X	X	X	25% Match	X
YCWA-04	North Area Irrigation Water Reuse	Yuba County Water Agency	$350,000	Ready	X	X	X	X	X		X	25% Match TBD	X
YCWA-05	South Yuba Canal Fish Screen	Yuba County Water Agency	$10.83M	Ready	X	X	X	X	X		X	25% Match	X
YCWA-06	Agricultural Water Conservation Evaluation	Yuba County Water Agency	$500,000	Concept	X		X	X			X	TBD	

Code	Title	Sponsor	Total Budget	PROJECT STATUS	**Criterion 1** Meets multiple objectives	**Criterion 2** Supports integration/ multiple RMSs	**Criterion 3** Technically and/or scientifically feasible	**Criterion 4** Assists region in adapting to climate change	**Criterion 5** Assists region in reducing GHG emissions	**Criterion 6** Addresses specific benefits to DACs	**Criterion 7** Regional/ Inter-regional benefit(s)	**Criterion 8** Funding match/ DAC waiver	**Criterion 9** Economic feasibility
YCWA-07	Forecast Coordinated Operations	Yuba County Water Agency	$1.5M	Concept	X	X	X	X			X	TBD	
YCWA-08	Groundwater Monitoring Program	Yuba County Water Agency	$250,000	Concept	X			X			X	TBD	
YCWA-09	Long-term Water Supply Sustainability Study	Yuba County Water Agency	$500,000	Concept	X	X		X			X	TBD	
YCWA-10	Narrows II Powerhouse Intake Extension	Yuba County Water Agency	$5M	Concept	X	X		X			X	TBD	
YCWA-11	New Bullards Bar Reservoir Reoperation Manual	Yuba County Water Agency	$500,000	Concept	X	X	X	X			X	TBD	
YCWA-12	New Colgate Powerhouse Tailwater Depression	Yuba County Water Agency	$6.2M	Concept	X	X	X	X			X	TBD	
YCWA-13	Regional Feather River Diversion Feasibility Study	Yuba County Water Agency	$500,000	Concept	X	X	X	X			X	TBD	
YCWA-14	Regional Flood Management Agency	Yuba County Water Agency	$500,000	Concept	X		X	X			X	TBD	
YCWA-15	Subsidence Monitoring	Yuba County Water Agency	TBD	Concept	X		X	X			X	TBD	
YCWA-16	Surface Water Measurement Program	Yuba County Water Agency	$500,000	Concept	X	X	X	X			X	TBD	

Code	Title	Sponsor	Total Budget	PROJECT STATUS	**Criterion 1** Meets multiple objectives	**Criterion 2** Supports integration/ multiple RMSs	**Criterion 3** Technically and/or scientifically feasible	**Criterion 4** Assists region in adapting to climate change	**Criterion 5** Assists region in reducing GHG emissions	**Criterion 6** Addresses specific benefits to DACs	**Criterion 7** Regional/ Inter-regional benefit(s)	**Criterion 8** Funding match/ DAC waiver	**Criterion 9** Economic feasibility
YCWA-17	Lower Yuba River Accord Implementation	Yuba County Water Agency	$5M	Concept	X	X	X	X			X	TBD	
YCWA-18	Lower Yuba River Accord Implementation - Fisheries Actions	Yuba County Water Agency	TBD	Concept	X	X	X	X			X	TBD	
YCWA-19	Yuba County Levee Project	Yuba County Water Agency	$750M	Concept	X			X			X	TBD	

Chapter 15 *Finance*

15.0 Introduction

IRWM Guidelines underscore the need for a blueprint to implement and finance the programmatic aspects and projects outlined in this Plan.[1] The intent of this chapter is to provide such a framework to the Regional Water Management Group (RWMG) and area stakeholders so they understand and can plan for the potential costs and revenues to sustain the RWMG, implement its program, and realize the proposed projects over time.

Project funding detailed in this and other state IRWMPs far exceeds the state's IRWM Program funding capacity. Therefore, funding and financing projects proposed under this Plan is anticipated to come from a variety of sources, such as public and private grants, user fees, and in-kind donations. IRWM Program funding will, in any case, require grant match from one or more of such sources.

The IRWMP will generate additional associated costs: updating and potential technical revisions to the Plan, and operation and maintenance costs of projects. These are considered in this chapter as well.

15.1 Funding of Ongoing Plan Implementation

Activities associated with implementing the programmatic aspects of the Plan (e.g., monitoring progress against objectives, Plan revisions, stakeholder outreach) are considered to be of a different nature than those of project-specific implementation. The RWMG is the group responsible for securing funding for its continuing IRWM Program.

For the Yuba County IRWM region, the RWMG has determined that it will secure funds needed for sustaining programmatic aspects of the Plan. Some Plan implementation costs also will be borne through an expenditure of time and/or materials by regional stakeholders and Plan adoptees. For full details on all aspects of Plan implementation, please refer to Chapter 16 *Governance*.

15.2 Ongoing Costs and Potential Funding Sources

Currently, the Yuba County Water Agency (YCWA) has taken a lead role in the IRWM process, both as the planning grantee and administrator, and by making space, support staff, and electronic media available for RWMG meetings. The RWMG is currently staffed by a project team preparing this Plan and funded by the IRWM Planning Grant. Once the IRWMP is complete and adopted, the RWMG will need to secure ongoing revenues to support the cost of implementation. Projected costs of Plan implementation are primarily associated with four items:

1. Coordinator support for internal communications, stakeholder involvement, tracking entities to make sure all project sponsors have adopted the IRWMP, Plan updates at set intervals, monitoring of Plan-level performance, database management, web maintenance, and tracking

[1] DWR Guidelines: Integrated Regional Water Management, Propositions 84 and 1E (November 2012).

the implementation grant proposal process with the Department of Water Resources (DWR) and other funders.

2. Securing necessary staffing to help prepare DWR Implementation Grant proposals and other sources of funding for region-wide projects or initiatives. The cost is difficult to estimate because much of the proposal work likely will be done by project sponsors. The bottom line is that the level of expertise required will dictate the cost.
3. Potential technical updates to the Plan. For instance, if the RWMG determined it needed to update emerging issues or refine existing section analyses based on new data, then the technical capacity to accomplish this might need to be sought from a future IRWM planning grant or other source.
4. RWMG-related costs for meetings, such as meeting venues, technical media, postage, and copying.

At its June 25, 2014, meeting, the Yuba County RWMG determined that within four years, YCWA may be able to bring an increased level of participation/investment to the Yuba County IRWM. The stakeholders identified that in the short term, they will maintain the IRWM group to ensure that it does not go into dormancy. They then determined the time allocation for a paid consultant to maintain the RWMG on an interim basis as 12 days per year, as broken out below:

- one meeting a year: meeting prep and follow-up included (3 days);
- monthly website update (1 day per quarter or 4 days);
- one meeting for project funding selection as opportunities emerge (3 days); and
- two additional days for as-yet-undetermined tasks, such as stakeholder outreach.

The IRWM group is interested in sustaining the IRWMP in a viable and meaningful way, and intends to approve a budget for Plan maintenance in fall 2014. Funding the IRWM Program is proposed as follows:

- Each entity has committed to approach its respective organization to secure funding in support of maintaining the IRWM. Annually, the RWMG will reassess commitments.
- Specifics of the formula for funding IRWM will be developed by the RWMG in September and October 2014. If the formula is not approved by that time, the process for development will be described in the Plan.
- The future fiscal agency or payment of invoices to the consultant will be determined as a part of this effort.
- A PowerPoint presentation being developed will contain topics related to future funding of the IRWM group and can be used for current and future presentations.

Each entity that ultimately adopts the Memorandum of Understanding and becomes a member of the RWMG after the planning process will be asked to recruit funds through board approval. The RWMG will need to consider equitable funding formulas for IRWM group investment.

Foundation and public grants are a secondary source of support. Public, private, and family foundations connected to the watershed or its attributes could be approached, both for technical reports and general RWMG support. Additionally, stakeholders may be able to include support for Plan updates within future DWR IRWM Planning Grant applications.

15.3 Project-Level Funding

15.3.1 Federal, State, Regional, and Private Grant and Loan Sources

A wide variety of grant sources could be sought to meet the needs of natural resources, infrastructure, and disadvantaged communities. Please see **Table 15-1** for a 2013-14 listing of federal and state grant and loan sources relevant to IRWMP projects.

15.3.2 Special Districts

A segment of the population may agree to form a special district and assess taxes for a much-needed service, improvement, or natural resource protection.

15.3.3 User Fees

Municipalities can choose to go through a public process to raise rates to pay for new or improved services. Rates need to be set commensurate with debt service costs, capital costs, equipment, and administration of the service. In a region such as the Yuba, where in some areas a high proportion of the population earns lower than the state's average household income, considerations of environmental justice and ability to pay are of high importance.

Table 15-1. Options for Project-specific Implementation Funding
Capital Improvements Program Funding (Revenue Bonds, Certificates of Participation) Property Tax Assessment (Assessed Valuation) User Fees
State Funding Proposition 84 Integrated Regional Water Management Planning Department of Water Resources – Local Groundwater Assistance Department of Public Health – Emergency and Urgent Water Protection State Water Resources Control Board – Storm Water Grant Program Local Levee Assistance Program Flood Protection Corridor Program Flood Control Subventions Program Urban Streams Restoration Program Proposition 1E Storm Water Flood Management Program Early Implementation Program Proposition 50 Department of Water Resources – Water Use Efficiency Grants Department of Water Resources – Contaminant Removal Department of Water Resources – UV and Ozone Disinfection Other State Funding California Financing Coordinating Committee (CFCC) State Revolving Fund (SRF) Safe Drinking Water SRF Infrastructure SRF Clean Water SRF State Water Resources Control Board – Federal 319 Program State Water Resources Control Board – Water Recycling Funding Program Department of Water Resources – New Local Water Supply Construction Loans Department of Housing and Community Development – Community Development Block Grant California Energy Commission (CEC) – Energy Financing Program
Federal Funding Environmental Protection Agency, Source Reduction Assistance Environmental Protection Agency, Wetlands Program Development Grants Environmental Protection Agency, Five Star Restoration Program Water Resources Development Act National Rural Water Association (NRWA) Revolving Loan Fund National Park Service (NPS), Rivers, Trails, and Conservation Assistance (RTCA) Program US Department of Agriculture (USDA) – Rural Development, Water and Waste Disposal Program US Bureau of Reclamation, WaterSMART, Grant Programs US Fish and Wildlife Service (USFWS), North American Wetlands Conservation Act Grant

15.4 Project-Level Financing

15.4.1 Certainty of Project Funding

Please refer to **Table 15-2** to see the list of prospective funding sources and funding that has been secured for Plan projects.

Table 15-2. Project Financing			
Code	**Title**	**Sponsor**	**Prospective/Secured Funding Sources**
AR-01	Yuba Gold Fields Integrated Flood Management, Habitat, and Recreation Project	American Rivers	▪ TRLIA – flood control project(s) under planning for Gold Fields ▪ Central Valley Flood Protection Plan, specifically regional flood plan for Feather River area to be implemented with bond funding ▪ Yuba Accord River Management Team funding ▪ USFWS Anadromous Fisheries Restoration Program (AFRP) ▪ YCWA – Yuba River Development Project (YRDP) relicensing outcomes ▪ Oroville Dam Relicensing Settlement Agreement, specifically Habitat Expansion Agreement implementation funds ▪ Future water bond funding for flood control, habitat, water quality, recreation ▪ In-kind donation of Gold Fields re-graded by gravel operators ▪ State, federal, private grant funds
BYLT-01	Yuba Land Conservation Easements	Bear Yuba Land Trust	▪ California Wildlife Conservation Board ▪ CalTrans Environmental Enhancement Mitigation Program (EEMP) ▪ USDA/NRCS Agricultural Conservation Easement Program (Federal Farm Bill) ▪ California Department of Natural Resources
BYLT-02	Yuba Watershed Forest and Fuels Project	Bear Yuba Land Trust	▪ PG&E Local Grantmaking Program ▪ State Fire Assistance (US Forest Service) - through Fire Safe California Grants Clearinghouse ▪ Cal Fire State Responsibility Area Fire Fee Grant Program ▪ Wood to Energy Grant Program (US Forest Service) ▪ Rural Energy for America Program (USDA Rural Development) ▪ Rural Business Enterprise Grant Program (USDA Rural Development) ▪ Rural Economic Development Loan and Grant (USDA Rural Development) ▪ Rural Business Opportunity Grants (USDA Rural Development)

Table 15-2. Project Financing			
Code	**Title**	**Sponsor**	**Prospective/Secured Funding Sources**
	Yuba Watershed Forest and Fuels Project *(continued)*		▪ USDA loans and loan guarantees ▪ Advanced Biofuel Payment Program (USDA Rural Development) ▪ Energy Efficiency and Conservation Block Grant Program (Department of Energy) ▪ Community Development Block Grant Program (California Housing and Community Development) ▪ Community Services Block Grant (California Community Services and Development) ▪ California Economic Development Lending Institute ▪ Wells Fargo Regional Foundation - Community Development Program ▪ Biomass Research and Development Initiative (USDA and Department of Energy) ▪ Electric Program Investment Charge (California Energy Commission) ▪ Sierra Nevada Conservancy
CCSD-01	Camptonville Water System Improvement Project (Phase II)	Camptonville Community Service District	▪ USDA Rural Development Fund ▪ California Department of Water Resources Water Bond funding programs ▪ California Department of Public Health SRF Fund ▪ Yuba County Water Agency (albeit temporarily unfunded) ▪ Camptonville Community Services District ratepayer income
WTLD-01	Citywide Storm Drain Improvement Project	City of Wheatland	▪ Street Improvement Fund (Gas Tax) ▪ California Department of Water Resources water bond funding
WTLD-02	Dry Creek Levee Improvement Project	City of Wheatland	▪ Developer funds ▪ California Department of Water Resources water bond funding
WTLD-03	North Storm Water Detention Basin Rehabilitation	City of Wheatland	▪ Developer funds ▪ California Department of Water Resources water bond funding
WTLD-04	Reclaimed Water Feasibility Study	City of Wheatland	▪ USDA Rural Development ▪ Sewer capital Funds

Table 15-2. Project Financing			
Code	**Title**	**Sponsor**	**Prospective/Secured Funding Sources**
WTLD-05	Storm Water Program Management - Equipment Purchase	City of Wheatland	▪ Street Improvement Fund (Gas Tax) ▪ California Department of Water Resources water bond funding
WTLD-06	Wastewater Treatment Plant Improvement	City of Wheatland	▪ USDA Rural Development ▪ Sewer capital funds ▪ Developer funds ▪ Developer impact fees ▪ California Department of Water Resources water bond funding
WTLD-07	Wheatland Water Supply Reliability	City of Wheatland	▪ USDA Rural Development ▪ Water capital funds ▪ California Department of Water Resources water bond funding
WTLD-08	Well System Monitoring Rehabilitation	City of Wheatland	▪ USDA Rural Development ▪ Water capital funds ▪ California Department of Water Resources water bond funding
MLD-01	Marysville Ring Levee Project	Marysville Levee District	▪ USACE Federal Appropriations and CA Prop 1E ▪ (in progress)
NYWD-01	Challenge Water Storage Tank Replacement	North Yuba Water District	▪ USDA Rural Development Fund ▪ California Department of Water Resources water bond funding ▪ California Department of Public Health SRF fund ▪ Rate payer income ▪ Loans
NYWD-02	Dobbins Oregon House Canal Improvement Project	North Yuba Water District	▪ USDA Rural Development fund ▪ California Department of Water Resources water bond funding ▪ California Department of Public Health SRF fund ▪ Rate payer income ▪ Loans
NYWD-03	Forbestown Ditch Improvement Project	North Yuba Water District	▪ USDA Rural Development Fund ▪ California Department of Water Resources water bond funding ▪ California Department of Public Health SRF fund

Table 15-2. Project Financing			
Code	**Title**	**Sponsor**	**Prospective/Secured Funding Sources**
	Forbestown Ditch Improvement Project *(continued)*		▪ Rate payer income ▪ Loans
NYWD-04	Forbestown Water Storage Tank and Pipeline Replacement	North Yuba Water District	▪ USDA Rural Development Fund ▪ California Department of Water Resources water bond funding ▪ California Department of Public Health SRF fund ▪ Rate payer income ▪ Loans
NYWD-05	New York Flat Road Water Transmission Main	North Yuba Water District	▪ USDA Rural Development Fund ▪ California Department of Water Resources water bond funding ▪ California Department of Public Health SRF fund ▪ Rate payer income ▪ Loans
NYWD-06	Rackerby Water Storage Tank Replacement	North Yuba Water District	▪ USDA Rural Development Fund ▪ California Department of Water Resources water bond funding ▪ California Department of Public Health SRF fund ▪ Rate payer income ▪ Loans
OPUD-01	Recycled Water Distribution System	Olivehurst Public Utility District	▪ California Department of Water Resources water bond funding ▪ Loans ▪ Rate payer income
OPUD-02	Olivehurst Water Main Replacement	Olivehurst Public Utility District	▪ California Department of Water Resources water bond funding ▪ Loans ▪ Rate payer income
RD784-01	Acquisition of Landside Urban Levee Maintenance Corridors	RD 784	▪ State grants ▪ Internal capital funds over 40 to 50 years
RD784-02	Chestnut Pump Station Reconstruction	RD 784	▪ State grants ▪ Internal capital funds over 40 to 50 years
RD784-03	Edgewater Detention Basin and Pump Station 5 Improvements	RD 784	▪ State grants ▪ Developer impact fees ▪ Internal capital funds over 40 to 50 years

Table 15-2. Project Financing			
Code	**Title**	**Sponsor**	**Prospective/Secured Funding Sources**
RD784-04	Pump Station 1 Reconstruction	RD 784	▪ State grants ▪ Internal capital funds over 40 to 50 years
RD784-05	Pump Station 2 System Improvement	RD 784	▪ State grants ▪ Internal capital funds over 40 to 50 years
RD784-06	Pump Station 10 Improvements	RD 784	▪ State grants ▪ Developer impact fees ▪ Internal capital funds over 40 to 50 years
RD817-01	FSRP LAN29 Critical Repair Project - Right Bank Bear River Set-back Levee	RD 817	▪ CA Flood System Repair program and Proposition 84 (secured, agreement in process)
RD817-02	Dry Creek Levee Feasibility Study	RD 817	▪ Yuba Feather Flood Protection Program (secured, agreement in process)
RD2103-01	Bear River and Dry Creek Levee Feasibility Study	RD 2103	▪ Funding TBD
SYRCL-01	Daguerre Point Dam Fish Passage Improvement	South Yuba River Citizens League	▪ USFWS Anadromous Fisheries Restoration Program ▪ Lower Yuba River Accord River Management Team (RMT) funding
SYRCL-02	Water Conservation Education	South Yuba River Citizens League	▪ YCWA ▪ Yuba County School District ▪ City of Marysville ▪ Matching funds from NID and PCWA
SYRCL-03	Yuba River Recreation Projects	South Yuba River Citizens League	▪ Long Foundation and other private foundations ▪ Yuba County
SYRCL-04	Yuba Salmon Education	South Yuba River Citizens League	▪ YCWA ▪ Yuba County School District ▪ City of Marysville
SYRCL-05	Yuba Salmon Habitat Restoration	South Yuba River Citizens League	▪ USFWS AFRP ▪ CADFW Fisheries Restoration Grant Program ▪ Private foundations ▪ Matching funds from private landowners ▪ In-kind volunteer hours ▪ Teichert ▪ Western Aggregates ▪ RMT
SYRCL-06	Lower Yuba Environmental Flows	South Yuba River Citizens League	▪ UC Merced CITRIS ▪ UC Davis Center for Watershed Sciences

Table 15-2. Project Financing			
Code	**Title**	**Sponsor**	**Prospective/Secured Funding Sources**
SCRCD-01	Hydrilla Eradication and Canal Lining	Sutter County RCD	▪ CDFA Weed Management Area ▪ Department of Water Resources water bond grant programs
YC-01	Yuba County Airport Drainage Improvements	Yuba County	▪ YCWA cost share ▪ Department of Water Resources water bond funding programs
YC-02	Linda Drainage Improvements	Yuba County	▪ YCWA cost share ▪ Department of Water Resources water bond funding programs ▪ Development impact fees
YC-03	Olivehurst Drainage Study	Yuba County	▪ YCWA cost share ▪ Department of Water Resources water bond funding programs
YC-04	Olivehurst Pump Station	Yuba County	▪ YCWA cost share ▪ Department of Water Resources water bond funding programs
YCWA-01	Groundwater Model Project (Phase 2)	Yuba County Water Agency	▪ Revenue from groundwater substitution transfers ▪ Contributions from YCWA member units who participate in groundwater substitution transfers ▪ DWR, LGA Grant Program ▪ State grants, Department of Water Resources water bond funding programs
YCWA-02	Irrigation Water Measurement Implementation	Yuba County Water Agency	▪ Contributions from YCWA member units ▪ YCWA general fund
YCWA-03	New Bullards Bar Outlet Capacity Increase	Yuba County Water Agency	▪ State grants, Department of Resources water bond funding programs
YCWA-04	North Area Irrigation Water Reuse	Yuba County Water Agency	▪ YCWA ▪ North member units ▪ Water transfer revenues ▪ State grants, Department of Water Resources water bond funding programs
YCWA-05	South Yuba Canal Fish Screen	Yuba County Water Agency	▪ State grants, Department of Water Resources water bond funding programs ▪ Member units receiving service from South Yuba Canal ▪ Loan from YCWA to member units

Table 15-2. Project Financing			
Code	**Title**	**Sponsor**	**Prospective/Secured Funding Sources**
	South Yuba Canal Fish Screen *(continued)*		▪ Federal grant programs (i.e., US Fish and Wildlife Service, NOAA Fisheries, Bureau of Reclamation)
YCWA-06	Agricultural Water Conservation Evaluation	Yuba County Water Agency	▪ State grants, Department of Water Resources water bond funding programs ▪ Federal grant program (NRCS)
YCWA-07	Forecast Coordinated Operations	Yuba County Water Agency	▪ In-kind services between DWR and YCWA ▪ Flood related grant programs such as Proposition 1E
YCWA-08	Groundwater Monitoring Program	Yuba County Water Agency	▪ Member unit contributions ▪ Revenues from groundwater substitution transfers ▪ State grants, Department of Water Resources water bond funding programs
YCWA-09	Long-term Water Supply Sustainability Study	Yuba County Water Agency	▪ State grants, Department of Water Resources water bond funding programs
YCWA-10	Narrows II Powerhouse Intake Extension	Yuba County Water Agency	▪ State grants, Department of Water Resources water bond funding programs as well as Fish and Wildlife Fisheries Restoration Grant Program ▪ Federal grant programs (i.e., US Fish and Wildlife Service, NOAA Fisheries, Bureau of Reclamation)
YCWA-11	New Bullards Bar Reservoir Re-operation Manual	Yuba County Water Agency	▪ State grants, Department of Water Resources water bond funding programs ▪ YCWA general fund for cost share
YCWA-12	New Colgate Powerhouse Tailwater Depression	Yuba County Water Agency	▪ State grants, Department of Water Resources water bond funding programs ▪ YCWA general fund for cost share
YCWA-13	Regional Feather River Diversion Feasibility Study	Yuba County Water Agency	▪ State grants, Department of Water Resources water bond funding programs ▪ Federal grant programs (USFWS, NOAA Fisheries, USBR) ▪ YCWA general fund for cost share
YCWA-14	Regional Flood Management Agency	Yuba County Water Agency	▪ State grants, flood related funding ▪ Participating local agency contributions
YCWA-15	Subsidence Monitoring	Yuba County Water Agency	▪ State grant programs ▪ YCWA cost share
YCWA-16	Surface Water Measurement Program	Yuba County Water Agency	▪ State grant programs ▪ YCWA cost share ▪ USGS cost share

Table 15-2. Project Financing			
Code	**Title**	**Sponsor**	**Prospective/Secured Funding Sources**
YCWA-17	Lower Yuba River Accord Implementation	Yuba County Water Agency	▪ YCWA Water Transfer Revenues ▪ Contributions from Lower Yuba River Accord participants
YCWA-18	Lower Yuba River Accord Implementation - Fisheries Actions	Yuba County Water Agency	▪ YCWA Water Transfer Revenues ▪ Contributions from Lower Yuba River Accord participants ▪ State and federal grant programs
YCWA-19	Yuba County Levee Project	Yuba County Water Agency	▪ State and federal grant programs

15.5 Financing Operations and Maintenance

Operations and maintenance (O&M) support of municipal and district infrastructure is currently provided via rate structure. Sometimes grants are received for upgrades, although this is rare. In the case of infrastructure replacement, upkeep is usually anticipated to be covered by cost savings from the replaced infrastructure. This allows payoff of federal loans that will, in turn, allow for payment of O&M.

15.5.1 Sewer and Water Systems and Flood Protection (Community Infrastructure)

User rates typically finance the O&M of public water and sewer systems and agencies, and would be expected to in the future. Customers can pay fixed rates, or variable rates tied to metering. Fixed rates often fund new infrastructure and remain on customer bills until the tank, pipeline, or other item is paid off. These rates are often tied to debt service and credit rating. The economic status of the region, with a significant portion qualifying as disadvantaged, makes raising rates particularly difficult for local agencies in some cases. Rate raises are not always made at an adequate pace to keep up with expenses. Significantly or abruptly raising sewer and water rates is unlikely.

One way of paying for O&M over time is to reduce this long-term cost through system design. Two examples would be use of solar or wind generators to power pumps, or use of gravity feed where possible. Alternative energy systems can be more costly upfront, but offer substantial savings once initial costs are amortized.

15.5.2 Agricultural Water Delivery/Efficiency

Agricultural water delivery projects' O&M would most likely be funded by landowners for individual projects. For multi-party projects, such as ditch lining and piping, O&M would likely come via assessments on water users by irrigation districts or water master programs.

15.5.3 Natural Resource Restoration

Post-restoration monitoring and maintenance agreements generally contain a two- to three-year term. O&M on other restoration projects in the region have included term-limited maintenance agreements with the private or public landowner, or grazing permittee, until the restoration objectives are established.

Chapter 16 *Governance*

16.0 Introduction

This chapter describes the structures and framework for governing the IRWM Program and Plan within the region, identifies the recruitment strategies used to diversify and balance access and opportunity to participate in Plan preparation and governance, describes how communication and collaboration are fostered with both the public and specific stakeholder groups, and discusses coordination with adjacent IRWM regions.

Additionally, the following section describes both the initial governance structure (known as the Management Group or MG) developed during preparation of the 2009 IRWMP document and process, and the refined governance structure (Regional Water Management Group or RWMG) developed for preparation of the Plan Update, as well as for ongoing Plan implementation.

16.1 Governance, Adoption, and Implementation – 2009 IRWMP

16.1.1 Governance Structure Established During 2009 IRWMP

In March 2005, Yuba County Water Agency (YCWA) and other water interests in the county formed the Management Group (MG) to develop the Yuba County IRWMP. The MG was the collective body of the project proponents. The group was responsible for developing the IRWMP, including the project prioritization criteria, and applying the criteria to the projects in the region to rank and prioritize the projects. The group met monthly from 2006 to 2008.

Initial stakeholder outreach was accomplished largely through direct notification of key agencies (e.g., North Yuba Water District, Yuba County Resource Conservation District, and City of Wheatland). MG meetings were designed and conducted as public meetings and included posting the agenda for the meetings on the YCWA website in advance of the meetings. Interested parties and the public were invited to participate in the meetings, which focused on discussion of regional water management issues. The MG participating agencies also used these meetings to provide comments on development of the Plan.

In the early MG meetings, a list of stakeholders was developed, with the potential stakeholders for this planning process organized into three categories:

1. members of the Management Group;
2. regional stakeholders located in Yuba County; and
3. statewide stakeholders, including local, state, and federal agencies.

Table 16-1. Stakeholders in Management Group – 2009 IRWMP
Regional Stakeholders include:
Brophy Water District Cordua Irrigation District Dry Creek MWD Hallwood Irrigation Company Ramirez Water District South Yuba Water District North Yuba Water District Wheatland Water District City of Wheatland Yuba County Resource Conservation District
Conservation Districts include:
Reclamation District 10 Reclamation District 817 Reclamation District 2103 California Water Service Company South Yuba River Citizens League
Statewide Stakeholders include:
Northern California Water Association California Department of Water Resources US Army Corps of Engineers

16.1.2 Process for Adoption of 2009 IRWMP

On February 7, 2006, the MG held a public hearing to brief the community on IRWMP requirements, the proposed planning process, and opportunities for public involvement, and to discuss the intention to prepare the Yuba County IRWMP. At the end of the meeting, staff was directed to prepare a draft Yuba County IRWMP.

When the public draft of the IRWMP became available in January 2008, notice was provided in the Appeal-Democrat newspaper and on the YCWA website to inform the public about its availability. Written comments on the draft Plan were collected at the public hearing and accepted directly by YCWA until February 12, 2008. After the close of the comment period, the Yuba County IRWMP project team reviewed all the comments and the draft Yuba County IRWMP was updated to address the comments as needed.

A public hearing was held on February 26, 2008, for YCWA to receive further public comment on the final draft of the Plan and, acting as the lead agency, to adopt the Yuba County IRWMP. A notice was published regarding the hearing date, time, and agenda; summary of the Plan; and the means for obtaining copies. Once adopted by YCWA, the Plan was adopted by the boards of the other members of the MG.

16.1.3 Activities after Adoption of 2009 Plan

The 2008 Yuba County IRWMP was adopted shortly before the “Great Recession” and its subsequent economic decline. The impacts of the recession were strongly felt across the region: staff was laid off, budgets were constrained, and already disadvantaged communities experienced a decline in capacity. As a result of this, and the fatigue engendered by a lengthy Plan development process, the MG began to meet less frequently and with diminished attendance. The focus of the meetings was largely on deciding to apply for planning grant

funds to update the Plan, preparing the Proposition 84 Planning Grant application, and discussing strategies for advancing the funding of projects.

16.2 Yuba County IRWMP Update (2013-2014) Governance Process

The Yuba County IRWMP Update began in 2013, with the receipt of a Department of Water Resources (DWR) Proposition 84 IRWM Planning Grant. The goal of the effort was to bring the 2009 Plan into compliance with the 2012 DWR IRWM guidelines. YCWA acted as the applicant and grantee for this effort. The work effort was initiated with receipt of the commitment letter in February 2013.

16.2.1 Governance Structure Revisited and Refined

Beginning with the first MG meeting, in June of 2013, the issue of decision-making in the context of Plan preparation and subsequent governance during Plan implementation was discussed. The following items were determined by the group (and reaffirmed at three subsequent meetings):

- The MG would become the Regional Water Management Group (RWMG), would act in a decision-making role for the duration of Plan preparation, and would be replaced by a new governance entity upon Plan adoption. (See **Figure 16-1**, Governance Structure.)
- Attendance at RWMG meetings during Plan preparation would be a determinant of ability to participate in formal decisions; participation in two out of three meetings was the minimum for eligibility to vote. No attendance limit was placed on participating in discussions and debate about Plan content or process.
- All decisions would be by consensus or, if consensus could not be reached, then by a 75 percent supermajority vote. (See **Figure 16-2**, Decision-making Process.)

The process for decision-making after adoption of the Plan was defined as follows:

- All attendees at any meeting may participate in the discussion as presented in the published agenda.
- All meetings will be noticed on the web and by mail (as requested).
- Eligibility to vote on any given issue or topic is limited to entities which have adopted the IRWMP and attended two out of the previous three meetings.
- Each entity will have a single vote.
- All decision meetings will focus on reaching consensus.
- If consensus cannot be reached then the group will refer the decision to a future meeting.
- At the future meeting, if the group is still unable to reach consensus, then the group may either:
    (a) Vote with one vote per entity, and in order to vote must have attended two out of last three meetings. If no consensus can be reached then a formal vote can be called. A 75 percent supermajority is required for a vote to be considered as binding.

    Or:

    (b) Refer the issue to a subsequent meeting.
- If no consensus can be reached after several meetings or if the requested vote does not result in a 75 percent supermajority, then the issue can either be referred to a future meeting or be tabled until such time as consensus is reached, or a 75 percent supermajority has been identified.

16.2.2 Memorandum of Understanding

The RWMG determined that, for the purposes of Plan adoption and implementation, the new governing body would need to be developed based on a Memorandum of Understanding (MOU). This MOU was developed and reviewed by the RWMG and is attached in **Appendix 16-1**. It covers such topics as representation, the decision-making process, formation of committees, formation of a management committee to coordinate the process between RWMG meetings, and budget development and oversight.

Figure 16-1

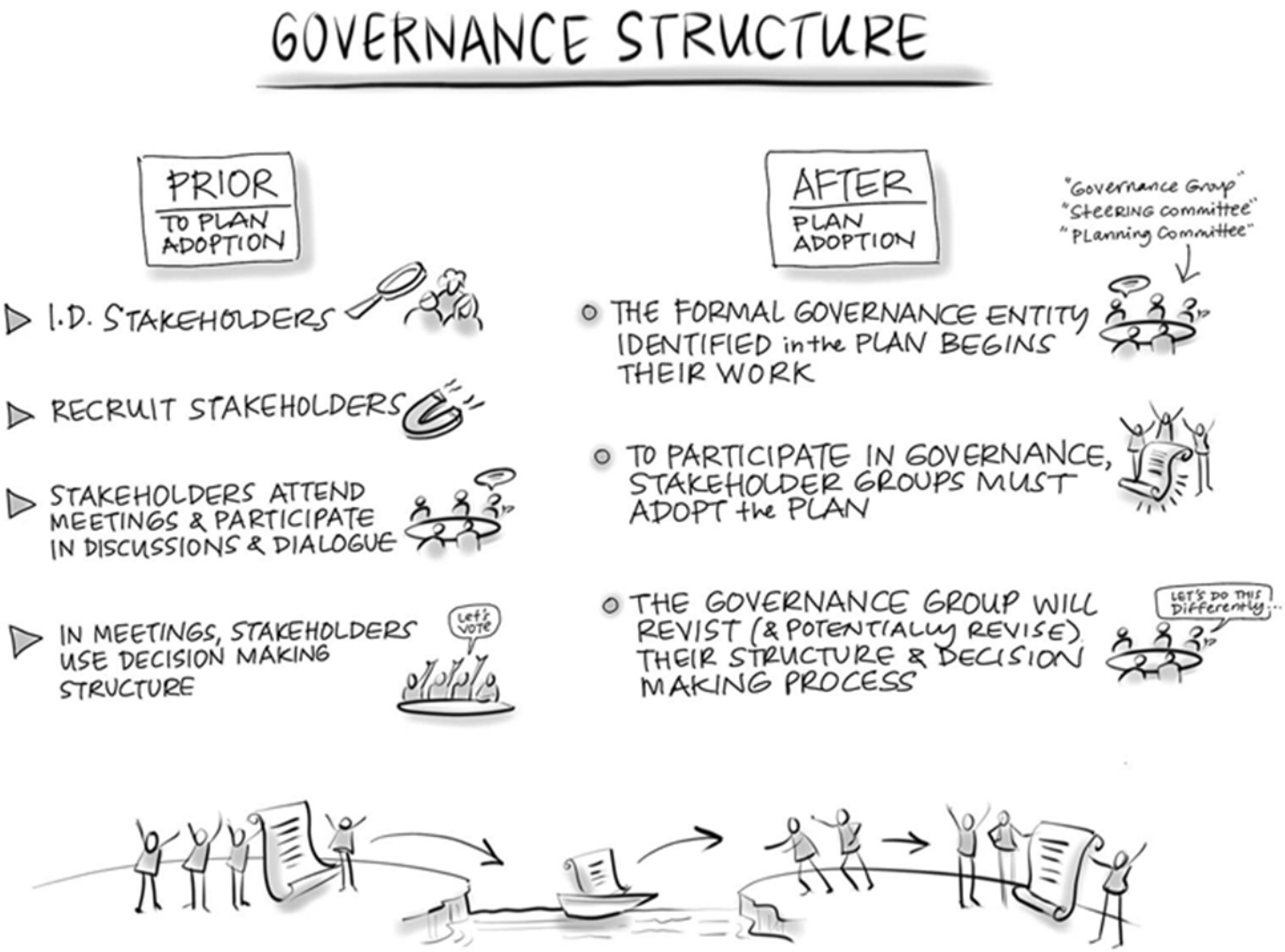
GOVERNANCE STRUCTURE
PRIOR
TO PLAN ADOPTION
I.D. STAKEHOLDERS
RECRUIT STAKEHOLDERS
STAKEHOLDERS ATTEND MEETINGS & PARTICIPATE IN DISCUSSIONS & DIALOGUE
IN MEETINGS, STAKEHOLDERS USE DECISION MAKING STRUCTURE
Let's vote
AFTER
PLAN ADOPTION
"Governance Group"
"Steering Committee"
"Planning Committee"
THE FORMAL GOVERNANCE ENTITY IDENTIFIED in the PLAN BEGINS THEIR WORK
TO PARTICIPATE IN GOVERNANCE, STAKEHOLDER GROUPS MUST ADOPT the PLAN
THE GOVERNANCE GROUP WILL REVIST (& POTENTIALLY REVISE) THEIR STRUCTURE & DECISION MAKING PROCESS
LET'S DO THIS Differently...

Figure 16-2

DECISION-MAKING PROCESS
ROUND 1
TALK, DISCUSS, DEBATE...
IF UNABLE TO REACH CONSENSUS, GO TO R2
OR
IF CONSENSUS:
DECISION MADE!
AND ACTION CAN BE TAKEN...
ROUND 2
TALK, DISCUSS, DEBATE...
OR
IF CONSENSUS:
DECISION MADE!
AND ACTION CAN BE TAKEN...
IF UNABLE TO REACH CONSENSUS, VOTE IN ROUND 2
o 1 vote/entity
o In order to vote, must have attended TWO CONSECUTIVE meetings
o 75% super majority
OR
ROUND 3 (FINAL)
TALK, DISCUSS, DEBATE...
OR
IF CONSENSUS:
DECISION MADE!
AND ACTION CAN BE TAKEN...
IF UNABLE TO REACH CONSENSUS, VOTE IN ROUND 3
o 1 vote/entity
o In order to vote, must have attended TWO CONSECUTIVE meetings
o 75% super majority

16.3 Process Used to Develop Objectives

See Chapter 12 *Goals, Objectives, Issues, and Conflicts* for a complete description of the development of goals and objectives for the Plan.

16.4 Coordination with Adjacent IRWM Regions

At the April 2014 RWMG meeting, several stakeholders volunteered to outreach to the adjacent IRWM regions, including CABY, Upper Feather, North Sacramento Valley, and American River Basin (ARB). Scott Matyac of YCWA contacted the North Sacramento Valley Four County Group and ARB; Jim Brobeck of AquAlliance contacted North Sacramento Valley Four County Group; and Rachel Hutchinson of South Yuba River Citizens League approached CABY, the Upper Feather River Watershed, and the Mokelumne Amador Calaveras. The outcome of these meetings is presented in **Appendix 4-1** and discussed more fully in Chapter 4 *Coordination*.

16.5 Long-term Implementation

The RWMG will be replaced by a formal MOU-based governing body after adoption of the Plan by the current RWMG. Subsequent adoption by individual entities is a prerequisite to membership in the new governing body (name to be determined). This group will oversee all aspects of Plan implementation including pursuit of funding for projects, updating and revising the Plan, continuing to develop and advance new projects, and continued recruitment of and management of relations with regional stakeholders.

16.5.1 Interim and Formal Changes to the IRWMP

The RWMG will be responsible to both interim and formal changes to the Plan.

Interim changes are considered to be changes that are in response to stakeholder-driven revisions such as adding new projects, revising or refining goals or objectives in response to emerging events or changing trends, and inclusion of appendices developed in response to ongoing work efforts (e.g., data management or changes to the Data Management System/DMS, outreach to Tribal or Latino stakeholders, updates of the regional description or climate change chapters). These informal amendments or revisions will occur at the discretion of the RWMG and may be instigated by individual stakeholders or the RWMG itself. As part of the RWMG ongoing Plan assessment process described in Chapter 17 *Plan Performance and Monitoring*, the group will determine on an annual basis if any amendments or Plan revisions are required. If so, then the group will follow the specific revision/update processes identified by the group following Plan adoption.

Formal changes to the Plan are considered to be revisions or changes to the Plan occasioned by revisions to the IRWM/DWR Guidelines. Such formal amendments will likely occur every three to five years. Typically, DWR will issue new guidelines and also initiate an associated funding round to support updated activities and processes. It is assumed that any such formal Plan revision will be managed by the RWMG and implemented consistent with the relevant DWR process and guidelines.

16.5.2 Project Updates, Additions, and Funding

An important aspect of the IRWM process is the continual development, refinement, implementation, and monitoring of projects. Following Plan adoption, it is assumed that the RWMG will contract for assistance in ongoing Plan refinement and project development.

This project development and tracking process is likely to include the following basic components and/or support: outreach to stakeholders to determine the status of their IRWMP projects on an annual basis; refinement of existing projects as required (with associated RWMG review and approval); identification of new projects by stakeholders with initial support for completion of the Project Application form and associated materials; developing options for project integration in response to project development and refinement (as well as external factors such as new funding priorities or emerging trends); monitoring the status of projects in terms of funding and implementation; and identifying opportunities for federal and state funding and supporting RWMG members and other regional stakeholders in refining and developing application materials. (Note: this activity may involve financial contributions by individual stakeholders or groups of stakeholders.) Some of these activities will result in amendments to the Plan within a discrete timeframe (such as development of new projects for Plan inclusion), while other activities may result in applications for funding which will not result in changes to the Plan until the project is completed.

The annual Plan review process will provide an opportunity to integrate project development activities into the Plan as appropriate.

16.6 Notice of Intent to Prepare an IRWMP

Per the 2012 DWR IRWM Program Guidelines, Appendix C, Governance:

> Public Notice Requirements: An RWMG proposing to prepare or update an IRWM Plan shall publish a Notice of Intent to prepare the Plan in accordance with Section 6066 of the Government Code. Upon the completion of the IRWM Plan, the RWMG shall publish a Notice of Intent to adopt the Plan in accordance with Section 6066 of the Government Code and shall adopt the Plan in a public meeting of the RWMG governing board (CWC Section 10543).

The required Notices of Intent were published twice in four different media papers which serve the local region.

The Appeal-Democrat which serves the Marysville area ran legal ads on November 11, 2013, and November 18, 2013.

Because of the overlap with the CABY region in the upper watershed, Notices of Intent were also placed in the three papers which serve the CABY area: The Mountain Democrat (Placerville, November 1, 2013, and November 18, 2013), The Auburn Journal (Auburn, October 31, 2013, and November 6, 2013) and The Union (Nevada City, October 31, 2013, and November 7, 2013).

Notices of Intent are provided in **Appendix 16-2**.

Chapter 17 *Plan Performance and Monitoring*

17.0 Introduction

Department of Water Resources (DWR) Guidelines for Integrated Regional Water Management Plans includes the standard that IRWMPs "shall include performance measures and monitoring to document progress toward meeting Plan objectives."

Performance measures are necessary for the RWMG and regional stakeholders to understand and measure the success of ongoing Plan implementation, following adoption by the RWMG and individual entities and organizations. Plan performance and monitoring falls into two primary categories: 1) Rural Water Management Group (RWMG) evaluation and measurement of the Plan's performance (progress toward accomplishing goals and objectives), and 2) monitoring and evaluation of individual projects against their respective performance measures and outcomes, conducted by project sponsors and reported to the RWMG.

17.1 Plan-level Performance Measures

The Yuba County IRWMP has developed objectives that include both quantitative or qualitative measures (see Chapter 12 *Goals, Objectives, Issues, and Conflicts*) as required by the DWR Guidelines. A series of performance indicators and a specific format for displaying the evaluation results will be developed in the context of the first year's performance evaluations. At this point in the RWMG process, the group has determined that development of performance metrics will be a part of the first annual meeting in 2015 that seeks to assess overall Plan performance.

The RWMG has identified preliminary measures of success which will be revisited during the initial formal Plan performance evaluation:

- how robust the IRWMP process has been post-Plan development (e.g., the number of meetings the RWMG has, number of attendees at those meetings, relevance of meeting agendas and outcomes to identified goals and objectives, recruitment of new attendees and/or retention of existing participants, timeliness of reporting, success of database management/number of new documents uploaded);
- adoption of the Plan by additional entities;
- the amount of additional funding developed to support essential RWMG activities;
- the number of new projects developed, projects funded and/or projects integrated;
- the specific outcomes of implemented projects when compared to the Plan sections and tables; and
- reduction of conflicts identified in the Plan, as measured by implementing systems for greater collaboration, and by qualitative perceptions of stakeholder participants.

17.1.1 Evaluation of Implementation Performance under 2008 IRWMP

The 2008 IRWM considered Plan performance measures in Chapter 8, section 8.3. While the section suggests an adaptive management approach, few specific Plan performance measures were indicated. Instead, the Plan identified regular reviews as the mechanism for measuring Plan progress in response to changing conditions. The Plan identified collection and evaluation of data as the primary evaluation tool.

Chapter 7, section 7.2.2 of the 2008 Plan describes specific data to be collected and evaluated (e.g., monitoring surface and groundwater conditions) both for periodic refinements to project descriptions, as well as IRWMP processes (e.g., reevaluating objectives and water management strategies, and periodically reevaluating the Plan). The Plan indicates that these periodic reviews/updates would be presented following completion of urban water management plans (in years ending in *0* and *5*. Finally, the Plan states that the RWMG would meet twice a year to review and update the project list and prioritization.

Following the economic decline in 2008, many of the participating entities experienced reduced budgets, staff reductions, and administrative constraints that prevented RWMG participation and tracking of emerging issues or data as outlined in the performance measures/processes listed above. Therefore, limited evaluation of Plan performance took place.

Based on extensive conversations with RWMG members by the project team as part of the project-related circuit-riding effort and other stakeholder outreach, it appears the following factors contributed to the limited implementation:

- process fatigue by area stakeholders that resulted in substantially reduced participation in the RWMG;
- inability of the group to pursue and secure project funding;
- need for a communications hub, such as a Yuba County IRWM website;
- need for funding dedicated to Plan review and evaluation and administrative coordination support; and
- lack of capacity to track DWR guideline and funding updates.

Lessons learned from the above analysis have generated an approach for the 2015 Yuba County IRWM Update to address these problems. A key focus of the Finance chapter is to create durable funding mechanisms; the Governance chapter provides administrative processes that, along with the newly created Yuba County IRWM website, will enhance communication and coordination among area stakeholders and the RWMG; and the Plan and Project Performance chapter contains specific performance measures tied to an implementation schedule. Administrative processes are designed to support streamlined and meaningful participation by stakeholders.

17.1.2 Process for Plan Evaluation

The group responsible for evaluating IRWMP implementation and performance will be the RWMG. The RWMG will convene a meeting to evaluate Plan performance at least once annually, and more often if needed to enhance chances for project funding, to respond to revisions to guidelines or updates to regulations, to take advantage of opportunities to improve the Plan, and to recognize and document circumstances in the watershed that substantively affect the Plan. The schedule for evaluation will be set forth when the RWMG adopts the Plan.

At minimum, the evaluation will consist of measuring Plan progress against the adopted Plan-level performance measures developed during the first evaluation session. As part of its adaptive management strategy to stay current and revise the Plan, the RWMG will compare implemented projects and their outcomes against objectives metrics to determine progress toward achieving the Plan's goals and objectives. New scientific data, regional conditions, or natural resource events could substantively alter the understanding of issues or solutions within the watershed. Potential alterations to the Plan goals or objectives will necessarily need to consider and address changes in water demand, water supply, water quality, and effects on

Disadvantaged Communities (DACs). For guidance on amendments to the IRWMP, please see Chapter 16 *Governance*.

The RWMG will determine whether objectives and their metrics continue to be relevant and appropriate. For instance, some objectives may be met, either by a change in circumstance, regulation, or implementation of projects. Objective metrics might need to be changed at that point, or a timeframe added to the metric to give it additional timeliness or urgency. New strategies and adaptations or mitigation may also emerge that warrant a change in objective or its metric.

Significant changes that affect aspects of the Plan may require more-frequent-than-annual Plan evaluations and revision. However, formal updates will occur at the discretion of the RWMG, and could be triggered by significant changes in governance structure, catastrophic changes to natural resources, or significant changes in regulations. Re-adoption will occur at least every five years to assure widespread buy-in by area stakeholders.

It is anticipated that additional information and data and, potentially, additional localized effects of climate variability will manifest in coming decades. While new studies and technologies may emerge for this relatively new science, localized climate information will not likely need annual updates as climate is the record of weather phenomena over the *long term*. Therefore, the RWMG may wish to search and review new climate studies annually, but revisit climate projections at longer intervals. Revisions to the Plan will accommodate these updated data and studies accordingly.

The RWMG will write up its Plan evaluations (annually at minimum) and will post evaluations on the Yuba County IRWMP website.

17.2 Project-level Performance Measures

Monitoring project performance is tied directly to project implementation; projects won't be evaluated unless they become either partially or wholly funded and implemented.

The outcomes of project implementation will be assessed with regard to achieving the objective metrics shown in **Table 17-1**, Goals-Objectives-Performance Metrics, at the end of this chapter. For example, if a Plan objective metric is to accomplish five miles of ditch lining while recovering 50 percent water loss, accomplishing three miles of ditch lining and the targeted conservation over a year would be documented against desired Plan outcomes.

Sponsors of existing and future projects will be expected to provide measures and outcomes for their projects which provide specific quantitative measures, based on the general measures listed below. Project sponsors will submit relevant information about projects and project performance to the RWMG's preferred data management system, via its website (see Chapter 19 *Technical Analysis and Data Management*).

17.2.1 Development of Project-level Monitoring Plans

Project sponsors will be responsible for development of monitoring plans for their respective project when applying to a funding source and will specify both who will conduct the monitoring and how it will be funded. Either the RWMG, or a specific committee, such as a Project Review Committee, will evaluate the monitoring plans at a specified interval to inform Plan progress. Monitoring outcomes and plans likely will also be evaluated by the respective funding source. As findings and the resulting lessons learned from monitoring

become available, they will be a valuable tool in improving project design in the future, amending resource management strategies, and altering objectives to be more responsive to watershed needs.

Both outputs (what the project consisted of, e.g., tank replaced) and outcomes (what the project accomplished in terms of Plan goals and objectives, e.g., water supply improved for a DAC for the life of the project) should be addressed where possible. In other words, monitoring needs to address not only that the project was achieved, but what it accomplished toward achieving Plan goals and objectives.

Monitoring plans will be prepared to the specifications required by a funding source. The following guidance is given for what DWR would expect in the typical contents of a project-specific monitoring plan:

1) *Clearly and concisely (in a table format) describe what is being monitored for each project. Examples include monitoring for water quality, water depth, flood frequency, and effects the project may have on habitat or particular species (before and after construction).*
2) *Measures to remedy or react to problems encountered during monitoring. An example would be to coordinate with the Department of Fish and Game if a species or its habitat is adversely impacted during construction or after implementation of a project.*
3) *Location of monitoring.*
4) *Monitoring frequency.*
5) *Monitoring protocols/methodologies, including who will perform the monitoring.*
6) *Data Management System or procedures to keep track of what is monitored. Each project's monitoring plan will also need to address how the data collected will be or can be incorporated into statewide databases. Note that standards and guidance related to the integration of data into statewide databases is included in Data Management Standard.*
7) *Procedures to ensure the monitoring schedule is maintained and that adequate resources (funding) are available to maintain monitoring of the project throughout the scheduled monitoring timeframe.*

As this Plan is implemented over time, the RWMG will need to reflect an update of impacts and benefits from the myriad projects undertaken during Plan implementation. Please see Chapter 18 *Impacts and Benefits*.

Table 17-1. Yuba County IRWMP Update Goals-Objectives-Performance Metrics	
The Relationship between Objectives and Performance Measures	
Goals and Objectives	**Performance Metrics**
Goal 1: Ensure adequate and reliable water supply that meets the diverse needs of the region	
Objectives	
1.1 Improve water supply system capacity, flexibility, and efficiency, including, but not limited to, optimizing existing water storage; upgrading and retrofitting aging infrastructure; and developing new infrastructure, where necessary	▪ Acre feet per annum of water supply conserved or enhanced ▪ Acre feet per annum water supply conserved per household ▪ Number of projects implemented ▪ Reduction in water system operational costs ▪ Tons of carbon sequestered or emissions avoided
1.2 Promote water conservation and water use efficiency by instituting various techniques including, but not limited to, groundwater recharge, conjunctive management, irrigation efficiencies, municipal water conservation, water recycling and reuse	▪ Acre feet per annum of water supply conserved ▪ Number of projects implemented ▪ Number of collaboratively developed plans and assessments ▪ Reduction in water system operational costs ▪ Tons of carbon sequestered or emissions avoided
1.3 Protect and restore water supplies that support watershed health	▪ Acre feet per annum of water supply conserved or enhanced ▪ Miles of stream where streamflow improved or protected ▪ Number of projects implemented ▪ Number and frequency of monitoring and assessment
1.4 Promote disaster preparedness and conservation planning efforts	▪ Number of collaboratively developed plans, studies, and assessments ▪ Number of stakeholders collaborating in the development of interregional drought response ▪ Number of planning efforts resulting in project implementation ▪ Number and diversity of people reached ▪ Number and diversity of outreach materials developed ▪ Measurable changes in knowledge or behavior
1.5 Maintain and enhance flood control infrastructure to protect water supplies	▪ Number of water supply facilities protected ▪ Number of collaboratively developed plans and assessments ▪ Number of stakeholders collaborating in the development of interregional flood response ▪ Number of planning efforts resulting in project implementation
1.6 Preserve water supplies that support recreational opportunities, ecosystem services, and agricultural uses	▪ Number of new, improved, or preserved economic activities ▪ Number of jobs created ▪ Acre feet per annum of water supply conserved or enhanced ▪ Miles of stream where streamflow improved or protected ▪ Number of projects implemented
1.7 Support regulatory compliance of state and federal water supply standards	▪ Number of projects implemented that comply with state and federal water supply standards ▪ Number of collaboratively developed plans and

1.7 *continued*	assessments ▪ Number and frequency of monitoring and assessment
1.8 Promote regional education and outreach regarding water conservation, water supply issues, and needs	▪ Number and diversity of people reached ▪ Number and diversity of outreach materials developed ▪ Measurable changes in knowledge or behavior
Goal 2: Protect, restore, and enhance water quality for water users and in support of healthy watersheds	
Objectives	
2.1 Protect and improve water quality by mitigating for urban, agricultural, and wildland (sediment) run-off	▪ Mass pollutant reduced per year ▪ Number of BMPs implemented ▪ Number of projects implemented ▪ Increased water quality monitoring and sampling ▪ Measurable improvement in water quality
2.2 Minimize water quality impacts from flood, effluent discharge, and wastewater spills	▪ Mass pollutant reduced per year ▪ Measurable improvement in water quality ▪ Reduced number of violations for water quality standards ▪ Number of BMPs implemented ▪ Number of water supply facilities protected ▪ Number of wastewater treatment plants designed to revised specifications considering climate change
2.3 Promote recreational activities and programs that minimize or mitigate impacts to water quality	▪ Number and frequency water quality monitoring and sampling ▪ Number and diversity of people reached ▪ Number and diversity of outreach materials developed ▪ Measurable changes in knowledge or behavior
2.4 Protect and improve the water quality generated by healthy, forested watersheds	▪ Number of fire and fuels management and watershed restoration projects implemented ▪ Linear feet of streambank protected or restored ▪ Mass pollutant reduced per year ▪ Acres of land treated, improved, or restored ▪ Number and frequency of water quality monitoring and sampling ▪ Number of BMPs implemented ▪ Measurable improvement in water quality
2.5 Maintain and improve water quality required to restore and protect freshwater ecosystems and fisheries	▪ Miles of stream protected or restored ▪ Number and frequency of water quality monitoring and sampling ▪ Number of BMPs implemented ▪ Measurable improvement in water quality ▪ Acres of riparian habitat and/or floodplain protected, restored or created ▪ Number of collaboratively developed plans, studies, and assessments ▪ Mass pollutant reduced per year
2.6 Support regulatory compliance with state and federal water quality standards	▪ Number of projects implemented to comply with state and federal water quality standards ▪ Number of collaboratively developed plans and assessments ▪ Number and frequency of monitoring and assessment ▪ Decrease in water quality violations ▪ Mass pollutant reduced per year ▪ Plant certification achieved

2.7 Protect public and ecosystem health from the physical and chemical hazards of Abandoned Mine Lands (AMLs)	▪ Number and acres of Abandoned Mine Lands (AMLs) sites improved or restored ▪ Mass pollutant reduced per year ▪ Measurable improvement in water quality
Goal 3: Preserve and restore watershed health and promote environmental stewardship	
Objectives	
3.1 Steward healthy forests through fire and fuels management, erosion control measures, wetland and groundwater-dependent ecosystems restoration	▪ Acres of land treated, improved, or restored ▪ Miles of stream protected or restored ▪ Acres of riparian habitat and/or floodplain protected, restored, or created ▪ Tons of carbon sequestered ▪ Number of projects developed or implemented ▪ Number of BMPs implemented ▪ Increased monitoring, sampling, and data analysis ▪ Measureable groundwater recharge
3.2 Identify and manage for aquatic and terrestrial invasive species and their impact on water supply infrastructure and watershed health	▪ Monitoring, sampling, and data analysis ▪ Number of collaborative plans, studies, and assessments developed ▪ Number of acres treated, improved, or restored ▪ Acres of riparian habitat and/or floodplain protected, restored, or created ▪ Number of projects implemented ▪ Number of BMPs implemented
3.3 Recover endangered and threatened fish species through habitat restoration and by providing access to historic habitat, wherever feasible	▪ Miles of stream protected or restored ▪ Acres of riparian habitat and/or floodplain protected, restored, or created ▪ Number of projects developed or implemented ▪ Acre-feet per annum streamflow improved ▪ Number of collaborative plans, assessments, studies developed ▪ Increased monitoring, sampling, and data analysis
3.4 Enhance floodplain function and wildlife habitat while achieving multiple flood management benefits and maintaining public safety	▪ Tons of carbon sequestered ▪ Miles of stream protected or restored ▪ Acres of riparian habitat and/or floodplain protected, restored, or created ▪ Number of projects developed or implemented ▪ Number of collaborative plans, assessments, studies developed ▪ Measurable groundwater recharge ▪ Lowering flood insurance rates/flood danger/risk
3.5 Promote watershed-level remediation of legacy mining toxins	▪ Number of projects implemented ▪ Number of collaborative plans, assessments, studies developed ▪ Mass pollutant reduced per year
3.6 Support environmental protections to prevent the extinction of economically, ecologically, and culturally significant species 3.6 *(continued)*	▪ Number of projects implemented ▪ Number of collaboratively developed plans, assessments, and studies ▪ Number and frequency of monitoring and assessment
3.7 Steward the region's biodiversity and ecological resources that directly provide opportunities for public access, recreation, and education	▪ Number and diversity of people reached ▪ Number and diversity of outreach materials developed ▪ Number of projects implemented

3.7 *continued*	▪ Measurable changes in knowledge or behavior
Goal 4: Enhance regional economic development by supporting recreational opportunities and sustainable agriculture	
Objectives	
4.1 Promote comprehensive recreation planning and implementation with a focus on regional economic development	▪ Number of collaboratively developed plans and assessments ▪ Percent of planning efforts resulting in project implementation ▪ Number of jobs created ▪ Number of businesses supporting project recreational features
4.2 Enhance river access points to encourage recreational use while managing for human impacts to watershed health	▪ Number of collaboratively developed plans and assessments ▪ Number of projects implemented ▪ Number of recreational amenities/opportunities developed ▪ Number of visitors to project recreational facilities
4.3 Create recreational river corridor linkages while enhancing migration corridors for plants and animals	▪ Number of collaboratively developed plans and assessments ▪ Number of projects implemented ▪ Miles of river enhanced
4.4 Explore opportunities to increase water-dependent tourism throughout the region while building local communities' capacity to manage their recreational amenities	▪ Number of collaboratively developed plans, assessments, and studies ▪ Number of projects implemented ▪ Number of recreational amenities/opportunities developed ▪ Number of businesses supporting project recreational features ▪ Number of jobs created ▪ Number of visitors to project recreational features
4.5 Protect and restore working landscapes, particularly ranch/ag lands, and the watershed benefits they provide	▪ Number of collaborative plans, assessments, and studies developed ▪ Number of acres treated or improved ▪ Number of acres of land preserved ▪ Number of projects implemented ▪ Number of BMPs implemented
4.6 Promote regulations that support local and regional economic resiliency by working with and among regulatory agencies to: 1) reduce regulatory conflicts, 2) ensure consistent enforcement of regulations, and 3) reduce costs and difficulty of meeting regulatory compliance	▪ Number of projects implemented that comply with state and federal regulations ▪ Number of collaboratively developed plans, assessments, and studies
Goal 5: Protect public safety through emergency and drought preparedness and integrated flood management	
Objectives	
5.1 Improve integrated flood management to ensure emergency preparedness, increase flood protection, and enhance regional and interregional collaboration	▪ Number of collaboratively developed plans and assessments ▪ Number of stakeholders collaborating in the development of interregional flood response ▪ Number of planning efforts resulting in project implementation ▪ Increased level of flood protection provided

5.1 *continued*	▪ Decrease in flood insurance rates and risks ▪ Miles of levees constructed or improved ▪ Number of projects implemented
5.2 Support regional and interregional collaboration to improve drought and emergency preparedness	▪ Number of collaboratively developed plans, studies, and assessments ▪ Number of stakeholders collaborating in the development of interregional flood response ▪ Number of planning efforts resulting in project implementation ▪ Decrease in flood insurance rates and risks ▪ Increased level of flood protection provided ▪ Miles of levees constructed or improved
Goal 6: Address climate vulnerabilities and reduce greenhouse gas emissions	
Objectives	
6.1 Support efforts to reduce greenhouse gas emissions in the region, particularly those related to water management operations	▪ Tons of carbon sequestered or emissions avoided ▪ Number of collaboratively developed plans and assessments ▪ Number of projects implemented
6.2 Improve data, modeling, and technical analyses to better understand the impacts of climate change on regional and interregional water supply and watershed health	▪ Data management improved ▪ WEAP model developed and expanded throughout the region ▪ Technical analytical capacity increased
6.3 Increase system flexibility and resiliency to adapt to climate variability	▪ Number of collaboratively developed plans, studies, and assessments ▪ Number of projects implemented ▪ Number of adaptive strategies implemented in the region and interregionally ▪ Number and frequency of monitoring, sampling, and analysis
6.4 Promote alternative energy and energy efficiency throughout the region	▪ Kilowatts of renewable energy production capacity created ▪ Tons of carbon sequestered or emissions avoided ▪ Number of projects developed or implemented
6.5 Promote education about climate change and its impacts on water management and watershed health throughout the region	▪ Number and diversity of people reached ▪ Number and diversity of outreach materials developed ▪ Measurable changes in knowledge or behavior
6.6 Promote regional and interregional collaborations to implement climate change adaptive management strategies	▪ Number of adaptive strategies implemented in the region and interregionally ▪ Number and diversity of stakeholders participating in regional discussion forums, such as the Sierra Water Work Group
Goal 7: Promote equitable distribution of resources to disadvantaged communities and Tribes across the region	
Objectives	
7.1 Support DAC and Tribal project development/ implementation activities by providing ongoing outreach, proposal and funding development assistance, and training	▪ Number of projects developed or implemented ▪ Number and diversity of people reached ▪ Number and diversity of outreach materials developed ▪ Number of trainings conducted ▪ Number of collaboratively developed plans, studies, and assessments ▪ Number of planning efforts resulting in project

7.1 *continued*	implementation
7.2 Prioritize ongoing participation of DACs and Tribes in the Regional Water Management Group	▪ Number and diversity of people reached ▪ Number of projects developed or implemented ▪ Number of DACs and Tribes actively participating on the RWMG ▪ Number and diversity of outreach materials developed
7.3 Foster partnerships to build the capacity of DACs and Tribes throughout the region to manage their own recreational amenities	▪ Number of projects developed or implemented ▪ Number and diversity of people reached ▪ Number and diversity of outreach materials developed ▪ Number of collaboratively developed plans and assessments ▪ Number of planning efforts resulting in project implementation ▪ Number of trainings conducted
7.4 Promote regional education and outreach in collaboration with DACs and Tribes	▪ Number and diversity of people reached ▪ Number and diversity of outreach materials developed ▪ Number of trainings conducted

Chapter 18 *Impacts and Benefits*

18.0 Introduction

Implementing the 2008 Plan and its subsequent Update has already generated and will continue to generate benefits and impacts at the Plan level (sometimes called the programmatic level), and from the project-specific perspective. This chapter describes, at a screening level, the impacts and benefits associated with Plan implementation, as well as any potential interregional effects. The impacts and benefits of Plan implementation for disadvantaged communities (DACs) and Tribal communities are also considered in this chapter.

Prior to implementation of projects, a project-specific impact analysis will occur, in conformance with applicable environmental compliance requirements (e.g., California Environmental Quality Act [CEQA] and National Environmental Policy Act [NEPA]). Chapter 14 *Project Application, Development, and Review* discusses the timing and process for ensuring adequate environmental analysis at a project level.

Regional impacts and benefits are summarized in **Table 18-1**. These impacts and benefits are organized by programmatic area and are assessed based on the Plan objectives contained in Chapter 12 *Goals, Objectives, Issues, and Conflicts*. Interregional impacts and benefits are discussed below in section 18.5. Arraying these impacts and benefits allows the RWMG and other decision-makers to choose best options for watershed management and potentially mitigate or avoid associated programmatic or project-level impacts.

18.1 Programmatic-level Impacts and Benefits

At a programmatic level, impacts from implementing this Plan will derive from increased responsibility for funding, administering, and managing the IRWMP. The Regional Water Management Group (RWMG) will need to marshal funding for support staff to organize and document meetings, for conducting outreach, and for maintaining the Yuba County IRWMP website. It will also be responsible for securing funding for and accomplishing revisions and potential updates to the Plan, coordinating with project development activities for implementing the Plan, and uploading new information to the IRWMP website shared-data sites.

At the project level, the greatest area of impact will be from costs and potential volunteer time to implement objectives and projects. Dedicated implementation will potentially entail pursuit of grants and other funding sources, both by project sponsors and potentially at the regional level by the RWMG; multiple forms of interpersonal contact involving stakeholder time commitment; project development, implementation, and monitoring; and Plan performance and monitoring. Indirect impacts of this work may include conflicts and their resolution. For DACs and Tribal stakeholders who may have limited resources, dedication of funding and staff time related to implementation may have greater impacts that could, in turn, slow or prevent some implementation measures.

Benefits have already accrued to area stakeholders from involvement in the 2008 Plan development, and will continue going forward. The full breadth of entities with interests in water management has been assembled, so that shared expertise, funding sources, and political power can be brought to bear on a cooperative basis for the benefit of the region. By way of example, flooding and the attendant risk to

public health, property, and natural resources is commonly recognized as a regional issue. The 2008 Plan and this Update have been an important platform from which to develop flood management projects on an integrated and cooperative basis. Interactions among stakeholders also heightened the importance of this source region to the remainder of the state, and highlighted the notion that benefits of the Plan extend beyond regional boundaries.

The benefits of programmatic-level implementation are wide-ranging and generally qualitative. They include:

- a potential reduction of identified regional water-related issues by meeting objectives, particularly for critical health and safety issues such as flooding;
- building capacity and funding sources for disadvantaged communities and Tribal interests to address critical water supply and quality needs, and to address issues of environmental justice;
- increased understanding and information sharing between area stakeholders and with interregional interests;
- preventing or resolving regional and interregional conflicts;
- identification of data gaps so that resources can be marshaled to address the most pressing issues;
- opportunities for collaboration and prevention of missed opportunities for project development;
- the ability to choose the most strategic and cost-effective solutions to regional issues as a result of both the IRWM process and the parallel and integrated Robust Decision Support process;
- potential identification of a more diverse set of funding sources to increase project-related investment in the region;
- opportunities for shared staffing, technical expertise, cost savings, and creating an economy of scale, particularly as a result of project integration;
- collaboratively addressing policy and regulatory issues facing the region; and
- developing and maintaining the Yuba County IRWMP website to assure ongoing collaboration, and a primary data and information source for water/watershed planning and management for the region.

The advantages of the regional approach also include increased opportunities to identify issues best addressed on a regional basis (e.g., involvement in water-related policy and regulatory issues, climate change vulnerabilities and adaptation strategies, and out-of-region water transfers).

Increased regional understanding has resulted from IRWMP meetings and preparation and review of Plan sections by stakeholders, both for the 2008 Plan and this Update, and involvement of Stockholm Environmental Institute (SEI) and its Robust Decision Support process during the Plan Update. Integration of projects has already resulted in, and will continue to allow for, better project design and refinement (from technical review and feedback among stakeholders) and a greater sense of shared regional concerns.

18.1.1 Identification of Funding Sources

A concerted effort has been made to identify funding for both implementing the programmatic aspects of, and projects developed under, this Plan in Chapter 15 *Finance*. The information offered can increase the chances a project will be funded because foundations and other funding entities often require a proposed project to be a component of a larger, deliberate process to achieve outcomes. Funders often

anticipate greater benefit from cumulative project (watershed-wide) implementation than from stand-alone projects, and often require demonstrated collaboration, technical data sharing, and opportunities for cost savings among stakeholders. Local adoption also demonstrates local support and project endorsement. Collaboratively developed projects, included in a deliberate local process and adoption by local entities, improve chances for individual projects or project suites to be funded by a variety of sources.

18.1.2 Venue to Address Policy-related and Regulatory Processes

Regional stakeholders have identified concerns that policies and regulations developed at the state level, such as Delta water supply and quality, may have substantial impact on the region. Further, conflicts among federal and state policies and regulations (such as control of rodents along levees) hinder water management and infrastructure maintenance. The RWMG provides a venue for discussion of these issues and a platform from which to develop solutions and organize responses. Collective responses from the region, and interregional solutions, are likely to carry more weight than a single entity's involvement in a policy or issue.

18.2 Project-level Impacts and Benefits

Project-associated benefits to the region far outweigh impacts, particularly since each project will be required to undergo environmental review. This review will include assessing alternatives and developing mitigations to reduce negative impacts, such as greenhouse gas emissions, prior to project implementation.

Impacts from project implementation are related to potential environmental or social disruption or disturbance. An important aspect of project inclusion in the Plan is the requirement that disturbance to the landscape, or construction-related project activities, will undergo examination for mitigation and environmental compliance evaluation under CEQA or NEPA prior to implementation. In many cases, projects such as feasibility studies, public education and outreach, and/or best management practice implementation would not result in direct physical environmental impacts. Additionally, small habitat restoration projects (under five acres with some provisions) are exempt from CEQA review.

Most proposed projects would result in localized and temporary environmental impacts. These could include, for example, disruptions in traffic and noise from infrastructure improvements, temporary increases in sediment from stream restoration, and short-term increases in air pollutants from prescribed burns. Socioeconomic impacts could result from rate increases or changes in review policies. The likely types of projects that would occur by programmatic area under Plan implementation are listed in Chapter 14 *Project Application, Development, and Review*.

Benefits from project implementation include alleviation of critical public health and safety problems (e.g., mitigation of flooding impacts from improvements in flooding infrastructure), improved coordination to help eliminate redundancy of project planning and development, and potential cost savings. Integration of project suites will potentially allow for shared equipment, technical expertise, and personnel.

Additional benefits include invigoration of the local economy and employment, and long-term benefits from improvements to natural resources and habitat that support fishing, rafting, and other water-

related recreational pursuits, and tourism. Energy conservation would result primarily from irrigation efficiency projects and improvements in municipal water delivery. Individual assessments of reductions in greenhouse gas emissions will be conducted as part of project evaluations with potential mitigations. Localized biomass and other alternative energy projects could conserve energy, employ construction workers, and potentially improve air quality. Adaptive strategies suggested to maintain the watershed's resilience under climate change would also reduce the region's vulnerability to drought, flooding, wildfire, and other climate-related phenomena.

18.2.1 Impacts from Failure to Implement the Plan

Regional stakeholders are committed to implementing this Plan. Were it not implemented, however, several impacts could occur: local water agencies and interests would suffer setbacks in meeting state-mandated water- and energy-conservation goals and objectives as well as state and federal regulations pertaining to water quality, flood protection, and habitat and species protection; progress toward overall watershed health would manifest on a piecemeal basis; critical health and safety issues could potentially persist or worsen; and collaborative processes, such as information sharing and integrated project development would no longer enjoy a robust framework and related benefits.

In the natural resources arena, low flows and past resource damage have placed certain species at risk, especially several aquatic-dependent species. Measures proposed under the goals and objectives and implementation projects associated with this Plan will likely promote conditions that aid imperiled flora, fauna, and fisheries. Without the Plan, habitat conditions could worsen, and loss of certain species could be hastened.

Hydrologic health has also been compromised by past mining practices, disconnecting channels from their floodplains, and from encroachment on floodplains by development and infrastructure. Failure to address legacy mining toxins could affect water supply and quality, an issue critical to human health and safety, economic security, and environmental justice.

Taking no action to curb the climate vulnerabilities identified in this Plan could result in both minor and major climate-related impacts on quality of life, human safety, the local and regional economy, and natural systems and wildlife species. Implementing projects identified in this Plan can enhance resilience (e.g., protecting habitat for endangered fish and wildlife), and potentially save lives and property (e.g., flood-mitigation projects).

Time-limited grant match has been secured for many projects included in this Plan. Failure to implement the Plan could result in a loss of this match and its economic contribution to the region. In-kind contributions could also be lost, cumulatively contributing to a forfeiture of regional investment in implementation projects.

Failure to implement the Plan could inflict some of the greatest impacts on those least able to afford recovery from such effects (e.g., loss of property or job loss from the effects of flooding or wildfire). Further, if domestic and recreational water quality were to decline within the region, residents of DACs would have the least recourse to correct this issue. Progress made to address environmental justice issues within the Plan would also go unrealized.

18.3 Impacts and Benefits – Assessing Progress

The RWMG will be responsible for assessing ongoing impacts and benefits from implementation of this Plan at annual intervals when overall Plan review takes place. The implementation schedule in Chapter 17 *Plan Performance and Monitoring* indicates timing of Plan reviews and revisions, while the performance measures in that same chapter will aid the RWMG in assessing future impacts and benefits, on regional and interregional bases.

Implicit in the interregional relationships created by the IRWM process is the *avoidance* of impacts upon neighboring regions, and the ability to create benefit on a broader scale through collaboration. Interregional impacts and benefits will be addressed via ongoing meetings with adjacent IRWM regions, and resulting assessment of interregional impacts and benefits added to the annual assessment.

Project sponsors will be responsible for monitoring and reporting progress, including impacts and benefits, from project implementation. The RWMG will contact project sponsors for a reporting on any implemented projects to include both qualitative and quantitative impacts and benefits in the RWMG's annual Plan assessment. Lessons learned from project implementation will also be documented to assist in future project development. Results of the Plan assessment of impacts and benefits will be available from the RWMG and will be posted on the Yuba County IRWMP website.

18.4 Impacts and Benefits to Disadvantaged Communities and Native American Tribes

Two population sectors are often under-represented in public planning: DACs and Native American Tribes. As discussed previously in Chapter 3 *Stakeholder Involvement*, a large portion of the regional population resides in or is affiliated with communities classified as disadvantaged under the DWR definition (80 percent or less of median household income). Eighteen Native American Tribal interests are included in the Yuba County IRWMP region. The IRWM process is designed to place special emphasis on the impacts and benefits of the Plan regarding these communities so that environmental justice issues, such as under-representation and a disproportionate share of any impact of Plan implementation, are addressed. Please see Chapter 3 *Stakeholder Involvement* for a discussion of the extensive process employed to involve under-represented interests in this planning effort.

By involving all constituencies in Plan development, it is likely that impacts to under-represented groups will be avoided at the programmatic level. Project-level impacts would likely be short-term, but could potentially occur more frequently in DACs because infrastructure project needs are likely the greatest in these communities. Construction-related impacts of noise, dust, and traffic disruption are typical of such projects. Required environmental reviews prior to project construction should ameliorate both temporary and long-term impacts. The only potential long-term impact identified to under-represented interests is possible increase of fees or assessments to accomplish infrastructure improvements, or other construction or restoration endeavors. However, the cost of project implementation is taken into account during environmental review, and the IRWM process can often reduce local costs through alternative funding.

The benefits to DACs and Tribal entities are likely to occur because long-term, financially sustainable solutions to water supply and public health and safety issues have been enacted. This would include

such measures as levee setbacks to allow, for instance, reclamation by the Yuba and Feather Rivers of their respective historic floodplains. Plan-related projects will likely also bring a source of short-term construction and restoration employment that could benefit local DACs. The RWMG and efforts by project sponsors can also attract sources of funding that would alleviate the need for local DACs to bear an entire cost burden. Projects proposed in this Plan would *directly* benefit DACs by: 1) providing clean domestic water supply, 2) improving flood protection, 3) enhancing recreational opportunities, and 4) constructing infrastructure improvements that would assure community water quality, reliable groundwater and surface water supply, and fire protection into the future. Proposals to enhance recreational opportunities, flood protection, and increased fire protection would also benefit disadvantaged local residents although these benefits are not critical to water quantity or quality issues. Each project proposed in this Plan has been evaluated as to its ability to address DAC and environmental justice issues.

Additional benefits to under-represented communities have come from the engagement with other water-management groups in this planning process. As discussed in Chapters 3 and 16 (*Stakeholder Involvement* and *Governance*), stakeholder outreach efforts and the governance structure proposed under this Plan have allowed, and will continue to allow, representatives to actively participate in the development and implementation of the IRWMP. Through this open process, the potential for grant funding, partnership, and matching funds will be available to communities previously overlooked by many regional planning efforts and funders. This will, in fact, occur during this Plan Update with the submittal of implementation projects under the state's emergency drought funding, with a substantially increased number of DAC-related projects and involvement of under-represented communities.

18.5 Interregional Benefits and Impacts

The venue provided by the IRWM process to increase understanding and information sharing between regional stakeholders and with interregional interests has already facilitated identification of similar issues between neighboring IRWMs (e.g., flood management and emergency preparedness and response, conjunctive management, anadromous fisheries recovery, fire and fuels management, and legacy mining remediation). The Yuba County IRWMP region shares boundaries with five adjacent IRWM regions: the American River Basin to the south, Westside IRWM to the west, North Sacramento Valley IRWM to the north, Upper Feather River IRWM to the northeast, and the CABY (Cosumnes, American, Bear, Yuba) IRWM directly to the east. The Yuba County IRWMP region overlaps with two adjacent IRWM regions: CABY and North Sacramento Valley. In the 2008 IRWM planning effort, the North Sacramento Valley and Yuba County IRWMP regions identified and worked on subbasin-level water management strategies. Considerable work has been done to characterize connectivity between groundwater basins in the Sacramento Valley. Depressurizing adjoining confined or semi-confined aquifers may create impacts that spread within or to other areas. Impacts to streamflow and groundwater-dependent ecosystems resulting from aquifer development can be identified only by establishing baseline conditions and installing monitoring infrastructure in each confined or semi-confined layer.

In the 2009 Region Acceptance Process, YCWA and the RWMG recognized CABY as the appropriate entity to organize natural resource-related planning efforts in the Upper Yuba watersheds. This agreement was formalized via a Memorandum of Understanding (MOU). The MOU formalizes the relationship in the overlap area between the IRWM regions and makes it clear that infrastructure projects within this area will be coordinated through the Yuba County IRWM region, while natural resource- and watershed-level projects in the overlap will be coordinated through CABY. The MOU further makes it clear that

stakeholders in both regions will be informed of the project development process in each region and invited to review proposed projects within the overlap area to ensure that management issues for both IRWM regions are adequately reflected. If projects within either region present an issue, the MOU stipulates a resolution process to ensure that divergent opinions or management priorities are reflected in final project design and implementation objectives.

As a source-water area for the rest of the state, the Yuba County IRWMP region's proactive role in water management and conservation under this IRWMP will benefit not only adjacent regions, but the state as a whole. Projects improving water conveyance, local habitat, species recovery, water quality, wildfire management, and flood management result in increased benefits to neighboring or downstream regions. The cumulative benefits of renewable energy projects (particularly biomass power generation), and energy conservation measures and project mitigations, will also help the state meet its goals relating to greenhouse gas emissions (e.g., AB 32), renewable energy generation (e.g., California's Renewable Portfolio Standards), and excess biomass utilization (e.g., CPUC's 2012 Bioenergy Action Plan).

Interregional benefits from this IRWMP will primarily derive from improvements to water supply and quality that could affect water bodies interconnected with other regions, such as the Sacramento River, and from habitat improvements that affect migratory species and their well-being, such as waterfowl and recovery efforts for imperiled fish and wildlife. Benefits to other regions could also occur from clarification and amendment of state policy or regulations, such as Delta water policy, that will affect source-water regions. Regional management of invasive species and wildfire will also benefit adjacent IRWM regions.

Conversely, lack of invasive species and fuel and fire management within the region could have interregional impacts. If regional management cannot reduce fuels loads, it is more likely that widespread, intense fires would spread from the Plan area to other areas. The spread of terrestrial and aquatic invasive species could have deleterious effects as well. Interregional impacts to groundwater could occur to or from the North Sacramento Valley region if coordinated management of groundwater did not occur. Future projects associated with the Plan would be evaluated for off-site, including interregional, impacts prior to implementation.

Table 18-1. Impacts and Benefits of Plan Implementation		
Program/Goal/Objectives	**Potential Benefits**	**Potential Impacts**[1]
Program: Water Supply Enhancement		
Goal 1: Ensure adequate and reliable water supply that meets the diverse needs of the region		
1.1 Improve water supply system capacity, flexibility, and efficiency including, but not limited to, optimizing existing water storage; upgrading and retrofitting aging infrastructure; and developing new infrastructure where necessary **1.2** Promote water conservation and water use efficiency by instituting various techniques including, but not limited to, groundwater recharge, conjunctive management, irrigation efficiencies, municipal water conservation, water recycling and reuse **1.3** Protect and restore water supplies that support watershed health **1.4** Promote disaster preparedness and conservation planning efforts **1.5** Maintain and enhance flood control infrastructure to protect water supplies **1.6** Preserve water supplies that support recreational opportunities, ecosystem services, and agricultural uses **1.7** Support regulatory compliance with current and future state and federal water supply standards services and agricultural uses **1.8** Promote regional education and outreach regarding water supply issues and needs	• Reduced vulnerability from climate-related reductions in seasonal or overall water supply • Better ability to manage groundwater supplies and prevent overdraft • Better ability to address seasonal low flows • Potential to increase cropland production • Potential to better manage, understand, and prevent over-drafting of groundwater supply, and understand the relationship of surface and groundwater • Reduction in irrigation water-delivery losses through improved delivery systems • Enhanced potential to maintain water-dependent recreational opportunities • Enhanced potential to recover imperiled species • Increased compliance with and potential improvement of state and federal water supply standards and rules • Improved public understanding about water supply issues and needs	• Potential increased conflicts among water-use sectors over available water supply allocations • Potential changes in flow regime and localized groundwater recharge associated with increased storage and infrastructure improvements, such as ditch lining • Short-term construction-related impacts of noise, dust, and traffic disruption • Increased pumping costs and energy use if groundwater use rises

[1] Note: All projects which involve construction activities have the potential to generate short-term impacts: noise, dust, and traffic disruption. These impacts are not called out individually in this table but are assumed for most construction-related projects.

Table 18-1. Impacts and Benefits of Plan Implementation *(continued)*		
Program/Goal/Objectives	**Potential Benefits**	**Potential Impacts**
Program: Water Quality Protection and Improvement		
Goal 2: Protect, restore, and enhance water quality for water users and in support of healthy watersheds		
2.1 Protect and improve water quality by mitigating for urban, agricultural. and wildland (sediment) run-off **2.2** Minimize water quality impacts from flood, effluent discharge, and wastewater spills **2.3** Promote recreational activities and programs that minimize or mitigate impacts to water quality **2.4** Protect and improve the water quality generated by healthy, forested watersheds **2.5** Maintain and improve water quality required to restore and protect freshwater ecosystems, fisheries, and groundwater-dependent habitat **2.6** Support regulatory compliance with current and future state and federal water quality standards **2.7** Protect public and ecosystem health from the physical and chemical hazards of Abandoned Mine Lands (AMLs)	• Improved health and safety for residents, including high percentage of DACs • Decreased treatment costs, especially for foothill communities • Potential to increase cropland production • Potential to aid in removal of specific 303(d) listings and indirectly reduce monitoring efforts and costs • Enhancement of recreational opportunities • Improved habitat quality for wetland-dependent and stream-dependent species, and subsequent potential to increase species resiliency and populations • Collectively and substantively address irrigation water delivery system to relieve chronic contributing factors to water quality degradation • Reduce potential water quality degradation from AMLs	• Potential short-term, construction-related costs, and site-specific disruptions to traffic, noise levels, water quality, habitat quality, service delivery, aesthetics, and cultural resources

Table 18-1. Impacts and Benefits of Plan Implementation *(continued)*		
Program/Goal/Objectives	**Potential Benefits**	**Potential Impacts**
Program: Watershed Health and Stewardship		
Goal 3: Preserve and restore watershed health and promote environmental stewardship		
3.1 Steward healthy forests through fire and fuels management, erosion control measures, and wetland restoration **3.2** Identify and manage for aquatic and terrestrial invasive species and their impact on water supply infrastructure and watershed health **3.3** Recover endangered and threatened fish species through habitat restoration and by providing access to historic habitat, wherever feasible **3.4** Enhance floodplain function and wildlife habitat while achieving multiple flood management benefits and maintaining public safety **3.5** Promote watershed-level remediation of legacy mining toxins **3.6** Support environmental protections to prevent the extinction of economically, ecologically, and culturally significant species and communities **3.7** Steward the region's biodiversity and ecological resources that directly provide opportunities for public access, recreation, education, while maintaining the co-equal objectives of flood protection and preservation of agricultural lands	• Reduced potential for large uncontrolled fires, and thus subsequent erosion and sedimentation and property loss by conducting forest health and small fuels reduction projects • Decreased invasive species extent and potential for invasion • Better habitat resiliency and connection will likely help species recovery • Potential to increase natural recharge and storage to augment late-season low flows and potential reductions in flood risks by reconnection of streams with their historic floodplains • Improved water quality from reduced sedimentation, decreased temperatures, and reduced introduction of surface water bacteria and nutrients • Increased ecological function from habitat connection, additional shade canopy, improved summer base flows, increased wetland extent and function, decreased peak flows, and improved bank and channel stability	• Short-term reduction in air quality from prescribed fire • Short-term, construction-related, and often site-specific disruptions to traffic, noise levels, water quality, habitat quality, service delivery, aesthetics, and cultural resources • Potential for introduction of non-native species from poorly managed equipment or limited restoration success • Additional herbicide contamination if application protocols not properly followed

Table 18-1. Impacts and Benefits of Plan Implementation *(continued)*		
Program/Goal/Objectives	**Potential Benefits**	**Potential Impacts**
Program: Enhance Economic Development		
Goal 4: Enhance regional economic development by supporting recreational opportunities and sustainable agriculture		
4.1 Promote comprehensive recreation planning and implementation with a focus on regional economic development **4.2** Enhance river access points to encourage recreational use while preserving flood control/water storage infrastructure and managing for human impacts to watershed health **4.3** Create river corridor linkages while enhancing migration corridors for plants and animals **4.4** Explore opportunities to increase water-dependent tourism throughout the region while building local communities' capacity to manage their recreational amenities **4.5** Protect and restore working landscapes, particularly ranch/ag lands, and the watershed benefits they provide **4.6** Promote regulations that support local and regional economic resiliency by working with and among regulatory agencies to: 1) reduce regulatory conflicts, 2) ensure consistent enforcement of regulations, and 3) reduce costs and difficulty of meeting regulatory compliance	• Enhancement of water-related recreational opportunities • Potential to maximize economic benefits while reducing potential conflicts via cooperative, integrated economic development planning • More streamlined regulations that reduce hardship on business operations while still maintaining public protections	
Program: Protect Public Safety		
Goal 5: Protect public safety through emergency and drought preparedness and integrated flood management		
5.1 Improve integrated flood management to ensure emergency preparedness, increase flood protection, and enhance regional and interregional collaboration **5.2** Support regional and interregional collaboration to improve drought and emergency preparedness	• Enhanced opportunities for aquifer recharge through reconnection of historic floodplains • Increased public safety and reduced risk to life and property • Increased water quality • Decreased flood insurance costs • Overall reduction in economic losses from flood and drought	• Depending on project design, potential loss of riparian/wetland acreage, land use restrictions, and short-term, site-specific construction impacts

Table 18-1. Impacts and Benefits of Plan Implementation *(continued)*		
Program/Goal/Objectives	**Potential Benefits**	**Potential Impacts**
Program: Address Climate Change		
Goal 6: Address climate vulnerabilities and reduce greenhouse gas emissions		
6.1 Support efforts to reduce greenhouse gas emissions in the region, particularly those related to water management operations **6.2** Improve data modeling and technical analyses to better understand the impacts of climate change on regional and interregional water supply and watershed health **6.3** Increase system flexibility and resiliency to adapt to climate variability **6.4** Promote alternative energy and energy efficiency throughout the region **6.5** Promote education about climate change/variability and its impacts on water management and watershed health throughout the region **6.6** Promote regional and interregional collaboration to implement climate change adaptive management strategies	• Contribute to meeting the state's 20x2020 goals for greenhouse gas emission reductions • Help prepare the region for optimum climate resiliency • Potentially reduce pumping and other electrical costs of operation through conservation • Increase regional climate knowledge to enhance water management	• RWMG and its partners may need to invest in future studies tailored to the region
Goal 7: Promote equitable distribution of resources to disadvantaged communities and Tribes across the region		
7.1 Support DAC and Tribal project development/implementation activities by providing ongoing outreach, proposal and funding development assistance, and training **7.2** Prioritize ongoing participation of DACs and Tribes in the Regional Water Management Group **7.3** Foster partnerships to build the capacity of DACs and Tribes throughout the region to manage their own recreational amenities **7.4** Promote regional education and outreach in collaboration with DACs and Tribes	• Increased involvement of and self-determination for under-represented communities in water management decision-making • Increased potential to address under-represented communities' water needs and projects	

Chapter 19 *Technical Analysis and Data Management*

19.0 Introduction

Technical analysis of water management information, and organizing and cataloging that information to support current and future analyses and decision-making, are essential for watershed management by a variety of stakeholders.

This chapter documents the background sources used to prepare this Plan and describes methodologies employed for analysis of relevant information. It presents the data gaps identified during the planning process to support efforts toward filling those gaps over time. Further, the system for current data management is described along with a system for proposed future data management by stakeholders and the Regional Water Management Group (RWMG). Finally, the processes for providing relevant technical data to state databases are explained.

A variety of entities contributed to data collection and analysis: NGOs and local and state agencies provided regionally specific information and contributed to data analyses and, subsequently, to future scenario development. Stakeholders also served on the Core Team and RWMG to supplement, refine, and approve presentation of information. A compendium of new data and information related to changes in the region since the 2008 IRWMP was prepared and is included in the Data Catalog posted under the Library tab on the Yuba County IRWMP website (yubairwmp.org/).

For preparation of the climate chapter, the project team conducted initial data gathering and then refined analyses with stakeholders and the Stockholm Environmental Institute (SEI) team. SEI conducted a parallel planning and modeling effort to encourage robust decision-making and, in doing so, generated not only a first-level analysis of data, but brought back an array of planning scenarios to inform stakeholder planning and decision-making.

Table 19-1 displays the primary sources of data used to prepare Plan sections, how the data/documents were relevant to Plan preparation, and specific notes that might help current or future stakeholders use or update a data source. When possible, information for at least a 20-year planning horizon was provided to help stakeholders plan for longer-term needs, such as infrastructure. Please see the IRWMP bibliography for an all-inclusive list of documents used during Plan preparation.

Further guidance on data management is provided in Chapter 17 *Plan Performance and Monitoring* that sets forth the process and intervals by which Plan-related data and analyses will be monitored, modified, and shared over time.

19.1 Technical Analysis

19.1.1 Background

The 2013 Yuba County IRWMP Update benefitted from a unique alliance: a project team that prepared a Department of Water Resources (DWR) guideline-compliant document and a parallel endeavor headed by SEI that developed a scenario-based computer hydrologic model, aided by a science-based decision

strategy called Robust Decision Support (RDS). The blended efforts were supported by the California Water Foundation to advance sustainable water management in the Yuba County IRWM region and to use this opportunity as a testing ground to potentially improve future IRWM planning processes throughout California. The RDS team's scope of work will be fulfilled beyond the timeframe of this Plan; future outcomes of that work are anticipated to be incorporated into this IRWMP during Plan revisions.

19.1.2 Analyses by the Project Team

The project team approached preparation of this Plan by conducting initial research and data collection through literature reviews; provision of information from stakeholders; and in some cases from the SEI team, stakeholder interviews, and Core Group and RWMG meetings. Sources included maps; data sets; research papers and texts; adopted policies, plans, and laws; climate and water modeling; and interviews with those having technical expertise in the region. The project team analyzed these sources and subsequently prepared Plan sections for review by the Core Group and/or RWMG. In this way, project team analyses were corroborated or refined by regional stakeholders.

To aid the reader who desires specific documentation of facts contained in this Plan, footnotes are provided. In the case of climate analyses, substantial technical data was used and/or generated for preparation of the chapter. Methodology for modeling and analyses to support the climate change chapter is provided below.

19.1.2.1 Modeling and Analyses to Support the Climate Change Chapter

Vegetation modeling: Vegetation modeling prepared for the CABY IRWMP (February 2014) included the Yuba County IRWMP region and was excerpted for the purpose of understanding climate impacts on vegetation in the context of this Plan. Methodology from the Draft CABY IRWMP is described below:

"The California Climate Change Center's 'Climate Scenarios' project, initiated in 2005 in response to then Governor Schwarzenegger's Executive Order S-3-05, analyzes potential climate change impacts on vegetation changes throughout the state, using the US Forest Service's MC1 model forced with lower (B1) and medium-high (A2) emissions scenarios. MC1 is a dynamic vegetation model with three components: 1) a simulation of plant type mixtures and vegetation types; 2) a description of the movement of carbon, nitrogen, and water through ecosystems; and 3) fire disturbance. The scenarios used for this work (B1 and A2) and the models feeding the climate forcing (GFDL and PCM1) are the same as those used in the state's Cal Adapt modeling scenarios. (Lenihan 2008)."

Greenhouse Gas Emission Calculations: Greenhouse gas (GHG) analyses were calculated for projects in this Plan that currently have sufficient data for analysis, to compare project alternatives and mitigate emissions under project design (see **Appendix 14-4**). To determine the average annual total GHG emissions, short-term construction emissions were divided over the life of the project. The total construction activity emissions are the sum of the emissions from construction equipment, transportation of construction workforce, transportation of construction materials, and construction electricity emissions.

Emissions from construction equipment were calculated by evaluating each equipment type. The maximum number of a specific equipment type per day was multiplied by the total operation days of that equipment to find the total operation hours. The fuel consumption per hour was determined either by a table from the California Air Resource Board, or by the sponsor of the project if he or she was

familiar with the equipment. The total fuel consumption was calculated by the product of the total operation hours and fuel consumption per hour. Finally, the total CO_2 equivalent emissions were determined in metric tons by multiplying the total fuel consumption by the CO_2 emissions per diesel gallon, which is 0.010 (from the World Resources Institute-Mobile combustion CO_2 emissions tool[1]). This process is repeated for each equipment type. The sum of these numbers is the total CO_2 equivalent emissions for the construction equipment.

The emissions from transportation of construction workforce were calculated next. The total miles traveled were determined by the product of the average number of workers per day, the total number of workdays, and average distance traveled (round trip). The total fuel consumption in gallons of gasoline was determined by dividing the total miles traveled by the average passenger vehicle fuel efficiency (which is provided by the US Environmental Protection Agency). This number was multiplied by the CO_2 emissions per gallon gasoline (0.009) to obtain the total CO_2 equivalent emissions in metric tons for the transportation of construction workforce.

The emissions from transportation of construction materials were subsequently calculated. There are two 'trip types': delivery and spoils. The total emissions were calculated the same way for both. The total miles traveled are determined by the product of the total number of trips and average trip distance. This number is then divided by the average semi-truck fuel efficiency to find the total fuel consumption, and then multiplied by the CO_2 emissions per gallon diesel to find the total CO_2 equivalent emissions in metric tons. The sum of this number for the two trip types equals the total emissions from the transportation of construction materials.

The construction electricity emissions were calculated simply by multiplying the amount of electricity needed in mega-watt hours by the amount of CO_2 per mega-watt hour, which is 0.310 (provided by eGRID2010[2]).

The total construction activity emissions are the sum of the total of emissions from construction equipment, transportation of construction workers and materials, and construction electricity. The average annual total GHG emissions are finally determined by the quotient of the total construction activity emissions and estimated project useful life in years.

19.1.2.2 SEI's Modeling and Decision Support

The Yuba County IRWMP Update involves a parallel process being conducted by a consulting team from SEI. While the project team prepared the DWR guideline-compliant IRWMP, the SEI team populated a sophisticated, scenario-based water model with regionally specific information to help determine the region's greatest water-related vulnerabilities and solutions to address them. This model is called the Water Evaluation and Planning model, or WEAP. Stakeholders were involved in a unique Robust Decision Support process during model development that, in turn, both enhanced their understanding of the model and improved the region's water-management decision-making. In effect, the Yuba County IRWMP process will serve as a test case for determining the utility of the WEAP and RDS applications in other IRWM processes across California. Please see **Appendix 11-2** for a description of RDS for this Plan.

[1] World Resources Institute, The Greenhouse Gas Protocol: Designing a Customized Greenhouse Gas Calculation Tool (June 2006). Available from: http://pdf.wri.org/GHGProtocol-Tools.pdf

[2] US Environmental Protection Agency, The Emissions & Generation Resource Integrated Database for 2010: (Egrid2010) Technical Support Document. Prepared by: E.H. Pechan & Associates, Inc. (December 2010).

19.2 Data Management

A standardized data management system is supported by the Yuba County RWMG because it provides both the underpinning for the preparation of the 2008 Plan and this Plan Update, and because it will aid water managers in finding and using reference and monitoring materials for future water management and planning. It will allow stakeholders to become informed and to share information they find valuable or relevant, and to upload and store IRWM-related materials on shared state databases. Further, project sponsors need data to plan, design, implement, monitor, and fund their respective projects.

19.2.1 Data Collection Techniques, Policies, and Procedures

The purpose of the Yuba County IRWM region's data collection policies and procedures is to clarify *who* will be responsible for data collection and posting, *where* that data will be stored, and *how* stakeholders can access the data.

The RWMG will be responsible for posting current events and documents related to the Plan and its updates, meetings related to the IRWM process, and materials relevant to projects and their funding. Project sponsors will be responsible for posting data related to their projects and for all project monitoring (interim and final). It will be the responsibility of the RWMG to post individual studies or non-project monitoring, or both, by working with the project authors and researchers. Monitoring data may be collected, stored, and disseminated on both the Yuba data management system (DMS) or on state databases, or both, as appropriate.

The RWMG will not dictate data collection protocols for projects; rather the entities with whom project managers are interacting will have their respective required data-collection techniques. Data necessary to update the Plan will be identified as part of the annual Plan review and will be refreshed and collected accordingly.

19.2.2 Data Collection, Management, and Contributions to State Data Systems

Data collection: Data collected during preparation of this Plan has been posted on the Yuba County IRWMP website (yubairwmp.org) under the library tab. Key documents related to IRWM planning have been downloaded, and links to the most commonly used state data systems and sites posted (e.g., State Water Resources Control Board [SWRCB], DWR/Division of IRWM). Future studies, maps, data sets, non-project-related monitoring results, research studies, relevant state guidelines and policies, agency plans, and other stakeholder contributions will be posted to the DMS by the RWMG on at least an annual basis. Plan revisions and updates and the materials used in the preparation of those updates will be uploaded by the RWMG.

Project sponsors will be responsible for collecting interim and final project monitoring data and outcomes and posting them to the DMS. The development of baseline assessment of indicator metrics, and methodologies for monitoring and tracking outcomes are discussed in Chapter 17 *Plan Performance and Monitoring*. These monitoring outcomes will be used to inform adaptive management and improve future project performance.

The functionality of the Yuba County IRWMP website was designed to serve as a data and communications portal for all IRWM processes. The site supports a library tab that will access technical documents and a searchable database linked to key words and phrases. The utility of this site will be enhanced by regular updates of current events, and by at least annual update of data and information by the RWMG.

The Yuba County IRWMP DMS system may provide data to many state data-sharing sites, where relevant and as required. These sites include the following at a minimum: California Environmental Resource Evaluation System (CERES), DWR's Water Data Library (WDL), California Environmental Data Exchange Network (CEDEN), California Data Exchange Center (CDEC), Surface Ambient Water Monitoring Program (SWAMP), Integrated Regional Water Information Systems (IRWIS), California Statewide Groundwater Elevation Monitoring Database (CASGEM), and USGS's National Water Information System (NWIS), and California Environmental Information Clearinghouse (CEIC).

Yuba County IRWM region stakeholders currently contribute data compatible with relevant statewide databases, including programs administered by the SWRCB and DWR. Stakeholders voluntarily participate in the SWRCB's Groundwater Ambient Monitoring Assessment (GAMA) program and CASGEM. Data collection will continue to be coordinated and shared with CERES, SWAMP, and other statewide efforts when appropriate and feasible. However, there is a lack of capacity and technical expertise for smaller and underfunded entities to access, use, and contribute to the myriad state databases, and this is unlikely to change given funding available for such capacity. Particular attention will be paid by the RWMG in aiding under-represented communities in data sharing.

The localized effects of climate change will manifest in coming decades and additional relevant information and data will be generated to supplement this Plan. Therefore, the RWMG will revisit climate projections and data in this Plan and supplement it at appropriate intervals to be determined by the RWMG. Revisions to the Plan will accommodate these new data and studies accordingly. IRWM Guidelines encourage RWMGs to stay involved with the California Natural Resource Agency's California Adaptation Strategy process and to consider joining the California Climate Action Registry at http://www.climateregistsry.org. New information and climate-related revisions to the Plan will be shared during RWMG meetings, project development processes, and on the Yuba County IRWMP website.

19.2.3 How Stakeholders Contribute and Share Data

Sharing and contributing data is facilitated in a variety of ways: via uploading information to the Yubairwmp.org website (with RWMG permission), uploading data to the appropriate state data system, participating in RWMG and work group/committee meetings, and attending non-IRWM-sponsored meetings, conferences, or workshops about water management, such as Feather River Flood Management team meetings. Federal data is generally accessed via the respective agency's website and personal contacts. Linkage to most commonly used state data-sharing sites also facilitates data sharing.

An annual 'call for information' will go out from the RWMG to ensure that the website is updated during annual Plan review. This prompt is included in the implementation table at the end of this document.

19.2.4 DMS Support

During preparation of the Plan Update, the project team improved the functionality of the website and designed a DMS. After the Plan is adopted, support of the DMS will become the responsibility of the RWMG and will be funded by mechanisms discussed in Chapter 15 *Finance* of this Plan.

It is assumed that a consultant will need to be retained to troubleshoot any problems with the website and provide improved functionality and improved and repaired linkages over time.

19.2.5 Responsibility for Maintaining Data

The RWMG will be responsible for ensuring that new studies relevant to regional water management, as well as Plan revisions and/or updates and Plan performance evaluations are uploaded to the Yuba County IRWM website. It is expected that the RWMG will keep the website current for matters pertaining to events and planning, and all project sponsors will add the information relevant to their respective projects and project monitoring. Support for uploading project-related information will be provided to project sponsors by the RWMG.

19.3 Data Needs and Gaps

Data gaps for better serving water managers in the region were identified during the planning process both by the project team's review of existing documents, and by stakeholders during meetings and project development interviews. These data gaps generally take the form of additional research and study, new or ongoing monitoring, and mapping and imagery.

Needs have been identified in two areas: 1) 200-year floodplain mapping for the region, and 2) additional research into the relationship between agricultural water demand and irrigation return flows. The following discussion applies to multiple data needs or stakeholders under a given topic.

19.3.1 Groundwater

While YCWA is carrying out a Measurement and Monitoring Program for the region's valley component, need exists for further monitoring and groundwater data to address the gap in knowledge necessary to fully and efficiently manage this resource. YCWA's Groundwater Management Plan (2012) identifies several data gaps that would aid water managers in a better understanding of regional volume, movement, quality, and resiliency of groundwater resources in the North and South subbasins. These informational needs include:

- information to help in the prevention of land subsidence;
- better understanding of surface water and groundwater relationship, including groundwater recharge, in the Yuba Gold Fields;
- better understanding of how changing land use (e.g., conversion from agricultural to residential) could impact groundwater resources; and
- a determination of 'safe-yield' of the basin for groundwater pumping from refinements to the Groundwater Adaptive Management Tool (GAMT) that shows modeled drawdown and recovery.

Obtaining additional information on the foothills' fractured-bedrock aquifers would also benefit county planners and rural residents who rely on groundwater for domestic or irrigation use. Fractured bedrock is known to be an unpredictable and sometimes unreliable water source. Extended drought, that may be further exacerbated by climate drying, has the potential to further affect fractured-bedrock-associated groundwater.

Conservation interests have identified potential habitat impacts associated with likely changes in water management practices in response to climate change. They advocate development of a program-specific network of shallow monitoring wells to detect changes in water levels over the shallowest portion of the aquifer. They believe that in evaluating impacts to certain wetlands species, it is important to discern both the rate of groundwater level change, as well as the cumulative change over the entire year. They suggest that data collection and monitoring frequency should be appropriately selected to support the temporal and long-term evaluations.

19.3.2 Agricultural Water Efficiency

A set of findings and recommendations published by the Ag Innovations Network[3] emphasizes the regional watershed management approach to agricultural water efficiency and conservation. It mentions the use of RWMGs and the IRWM process as the preeminent venue for meaningfully engaging agricultural stakeholders and recognizes past under-representation from this sector. Its recommendations can be used as a checklist during the planning process to assess whether ag-related water issues have been adequately addressed and whether the agricultural community has been sufficiently engaged. The findings say that, "Nearly a quarter of farmers surveyed by the Agricultural Water Management Council said that lack of technical assistance limited their ability to implement water conservation practices." This is particularly relevant in the time of agency budget cuts and when considering potential limitations to project development.

19.4 Quality Assurance of Datasets and Information

Referenced materials used to prepare this Plan originated from sources that were peer reviewed, created within academia or the scientific community, prepared by public agencies, or reviewed for individual veracity during public review processes. Technical data sets generally came from trusted sources, such as population data from the US Census, flow data from the USGS, or monitoring datasets from water management agencies.

Methodologies for preparing and analyzing data that contributed to this Plan are discussed in previous sections of this chapter. In the future, if it is brought to the attention of the RWMG that an information source(s) is suspect, or a disagreement over facts arises, the RWMG will set up a process for hearing a defense of the material, or will evaluate materials from both sides of a factual disagreement before determining how and whether to accept those data into the IRWM process.

Part of the adaptive management process of the Plan will be to encourage feedback about information and to incorporate better technologies for information-sharing as they arise.

[3] Ag Innovations Network, Agricultural Water Stewardship: Recommendations to Optimize Outcomes for Specialty Crop Growers and the Public in California. California Roundtable on Water and Food Supply (June 2011). Convener: Ag Innovations Network, Sebastopol, CA. Available from: http: aginnovations.org/articles/view/stewardship_recs/

Table 19-1. A Summary of Primary Studies and Data Sets Used in Preparing the Yuba County IRWMP		
Name of Study/Data Set	**Use in the IRWMP**	**Other (e.g., status of data, certainty of data/analysis, relevance to other sections)**
Water Quality		
Alpers, C.N., M.P. Hunerlach, J.T. May, and R.L. Hothem, Mercury Contamination from Historical Gold Mining in California, Fact Sheet #: 2005-3014 Version 1.1. US Geological Society (Sacramento, CA, 2005): http://pubs.usgs.gov/fs/2005/3014/fs2005_3014_v1.1.pdf.	Used to describe how fish from reservoirs and streams in the Bear-Yuba watersheds have bioaccumulated sufficient mercury to pose a risk to human health.	
Black & Veatch Corporation and Standish-Lee Consultants, Watershed sanitary survey update and source water assessment (2002).	Used to describe possible sources of various pollutants.	
California EPA, Central Valley RWQCB, The Integrated Report - 303(d) List of Water Quality Limited Segments and 305(b) Surface Water Quality Assessment, Sacramento, CA; State of California (2011). http://www.swrcb.ca.gov/centralvalley/water_issues/tmdl/impaired_waters_list/index.shtml.	These analyses were used to characterize the nature and status of water quality impairment for stream reaches.	These data are updated, so should be consulted periodically.
CDFW, California Aquatic Invasive Species Management Plan (2008).	Used to describe problems with AIS species throughout California.	
Central Valley RWQCB, Water Quality Control Plan (Basin Plan). 4th ed. (2007).	The State of California identified the Bear River and South Fork Yuba River as Priority 1 Impaired Watersheds requiring restoration to improve water quality as a result of the large amounts of mercury.	Also used in Land Use chapter.
Curtis, J.A., L.E. Flint, C.N. Alpers, S.A. Wright, and N.P. Snyder 2001-03, Sediment transport in the Upper Yuba River Watershed, California U.S. Geological Survey Scientific Investigations Report 2005-5246 (2006): http://pubs.usgs.gov/sir/2005/5246/.	This report summarizes various studies of the Yuba River and adjacent watersheds which suggest that smaller tributaries are asymptotically incising toward pre-mining channel-bed elevations. This causes remobilization of hydraulic mining sediment and continues to affect sediment yields from impacted basins. It also contributes to lost water storage space in reservoirs.	
DWR, 2013 website search. Watershed Management Initiative.	Used to compare the Yuba County IRWM region's water quality issues with the issues addressed in the Central Valley RWQCB's 2003 Watershed Management Initiative, Central Valley Reports.	Also used in Land Use chapter.

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DWR, California Water Plan Update (2009).	Used to describe water transfers.	Also used in Water Supply chapter.
DWR, Upper Yuba River Watershed Chinook Salmon and Steelhead Habitat Assessment (June 2006).	Used to describe low flows, high water temperatures, and sediment on the South and Middle Yuba Rivers which have contributed to problems for the cold-water adapted aquatic communities.	
Placer County Water Agency, Middle Fork American River Hydroelectric Project FERC relicensing website. FERC data and studies (2013).	Important water quality information, especially used to enhance understanding of mercury methylation in the Upper Yuba watershed.	Includes a variety of statistical, biological/scientific, economic, hydrological modeling, and physical monitoring species.
Sacramento Valley Water Quality Coalition, Monitoring and Reporting Program: Annual Monitoring Report 2013.	Used to describe salts in the Yuba County IRWM region which were found to be low-threat with zero exceedances found since 2003.	
Schilling, F. (n.d.), State of the Yuba: an assessment of the Yuba River watershed (Nevada City: University of California).	Describes how the high concentrations of suspended sediment in the Humbug Creek watershed can be attributed to abandoned mines in the Malakoff Diggings Historical State Park and clear-cuts on private lands.	
Schmitt, J. and A. Michael, Rainfall infiltration under urban soil surface conditions – experiment and model results, 13th Annual Soil Conservation Organization Conference: Conserving Soil and Water for Society: Sharing Solutions (Brisbane) (July 2004).	Used to describe how increasing development and the conversion of lands to impervious surfaces can also result in pollutant spikes during storm events.	
USGS, Bear-Yuba Watersheds Interagency Abandoned Mine Lands Project (2000). http://ca.water.usgs.gov/mercury/bear-yuba/.	Provided data concerning mercury and methylmercury in water, sediment, and biota from sites in the Bear River watershed. These data are available online.	
USGS and SWRCB, Groundwater Quality in the Middle Sacramento Valley, California. A fact Sheet by George L. Bennett, V. Miranda, S. Fram, and Kenneth Belitz. (2011).	Used to describe the geochemical conditions in the sediments which favor arsenic solubility. These trace and minor elements naturally occur in the Yuba County region.	
Wiener, J.G., C.C. Gilmore, and D.P. Krabbenhoft, Mercury strategy for the Bay-Delta Ecosystem: a unifying framework for science, adaptive management, and ecological restoration. La Crosse, Wisconsin: University of Wisconsin (2003).	Provided data concerning mercury and methylmercury in water, sediment, and biota from sites in the Bear River watershed. These data are available online.	

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YCWA, Federal Energy Regulatory Commission (FERC) #2246, Yuba/Bullard Bar Project: Relicensing website data. (Accessed September-December 2013 online).	Temperature modeling maps of the Yuba River were prepared for YCWA as part of FERC relicensing. These maps were used to help describe temperature issues in the Yuba River.	
YCWA, Yuba County Water Agency Groundwater Management Plan (2010).	Used to describe elevated levels of TDS and deep groundwater pumping which can negatively impact irrigated agriculture and the taste of domestic drinking water. Also used to summarize the percent of irrigation water that comes from groundwater, groundwater elevations, and wells.	Also used in the Climate Change and Water Supply chapters.
YCWA, Groundwater Management Plan, Update to Board (September 12, 2006).	Describes how groundwater levels have largely recovered from historical overdraft, except in the Wheatland area, because of YCWA's surface water project.	
Water Supply and Demand		
2030 Yuba County General Plan Update (Adopted June 7, 2011).	The Plan and 2008 background reports were used to support population and land use growth and development trends as background for water supply and demand analyses.	This document was also used in the Land Use, Climate Change, and Region Description chapters.
California Department of Finance, Population Projections by Race/Ethnicity for California and Its Counties 2000–2050. Sacramento, CA (May 2012). http://www.dof.ca.gov/research/demographic/reports/projections/p-1/.	Used to support supply and demand analyses.	
California Water Service Company. 2010 Urban Water Management Plan – Marysville District (Adopted June 2011).	Assesses the state of supply for the Marysville District. Used as background for the water supply and demand analyses.	

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DWR, California Water Plan Update (2009).	Used to describe the Sacramento Area (which Yuba County is a part of), as defined by the California Water Plan Update, acres of agriculture land converted to urban or nonagricultural purposes.	Also used in Water Quality chapter.
DWR et al., 20x2020 Water Conservation Plan (2010).	Used to describe water conservation targets and potential statewide savings.	
DWR, 2013 (draft). Water plan data for the Water Plan Information Exchange is currently being updated. Therefore previous data as cited below was used. Website reviewed on June 17, 2014, from http://www.waterplan.water.ca.gov/waterpie/index.cfm DWR. 2002. Water plan data, wild and scenic rivers water use. Originally retrieved August 21, 2006, from http://www.waterplan.water.ca.gov/docs/waterpie/wpdata/WildandScenic.98.00.01.xls.	These data were used to calculate the environmental water demand for the South Yuba River.	
DWR, 2013 (draft), Water plan data for the Water Plan Information Exchange is currently being updated. Therefore previous data as cited below was used. Website reviewed on June 17, 2014, from http://www.waterplan.water.ca.gov/waterpie/index.cfm DWR, Water plan data, wild and scenic rivers water use (2002). Originally retrieved August 21, 2006, from http://www.waterplan.water.ca.gov/docs/waterpie/wpdata/WildandScenic.98.00.01.xls.	The Yuba County IRWM region contains approximately 39 miles of the Wild and Scenic South Yuba from Spaulding Dam to the upper limit of Englebright Reservoir.	
DWR, California Water Plan Update Bulletin, v.2:160-98 (1998).	This Plan provides an overview of flows in Wild and Scenic Rivers throughout California which constitute the largest environmental water use. This Plan was also used to define environmental flows.	
DWR, Initial Information Package, Relicensing of the Oroville Facilities. FERC License Project No. 2100 (2001).	The Initial Information Package was used for the discussion on environmental flow data and data supporting the Yuba Accord.	

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DWR, Groundwater Information Center, http://www.water.ca.gov/groundwater/	This website was used extensively to describe the relationship between ground and surface water. Various graphics were reviewed to help illustrate groundwater and surface water interactions.	
Groves, D.G., S. Matyac, and T. Hawkins, Quantified scenarios of 2030 California water demand. In California Water Plan Update 2005. Sacramento, CA: California Department of Water Resources (2005).	This reference defines environmental water demand and uncertainties in calculations. Used in water supply section.	
Linda County Water District, 2010 Urban Water Management Plan.	Assesses the state of supply for Linda County Water District. Used as background for the water supply and demand analyses.	Used by urban water agencies in the region; monitor for updates.
Olivehurst Public Utilities District, Final 2010 Urban Water Management Plan. Prepared by Atkins. Adopted November 17, 2011.	Assesses the state of supply for Olivehurst PUD. Used as background for the water supply and demand analyses.	
US Census Bureau, quickfacts.census.gov	Used to support supply and demand analyses.	
YCWA, Yuba County Water Agency Groundwater Management Plan (2010).	The Plan illustrated groundwater levels, flows, transfers, locational extent, and planning to inform the water supply and demand discussion extensively.	Also used in the Climate Change and Water Quality chapters.
Yuba County Department of Agriculture, Agricultural Crop Report (2012).	Describes the dominant agricultural crops in Yuba County. Used in water supply and region description sections.	
Flooding		
California Department of Water Resources, Sacramento and San Joaquin River Basin Comprehensive Study (2013).	Three selected studies were reviewed to identify the percent of Yuba County IRWM region that falls in the 200-year flood plain.	
City of Wheatland, External Source Flood Protection Plan (2005).	Stakeholders recommended we review this document. This proposed project would include the development of 14,329 residential lots on approximately 4,069 acres located within Yuba County. Although data was not cited directly in the IRWMP, the plan was reviewed and taken into consideration as part of preparation of this IRWMP Update.	

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Coalition Members of the Feather River Regional Flood Management Team, Draft Feather River Regional Flood Management Plan (October 2013). Coalition Members of the Feather River Regional Flood Management Team, Revised Final Draft Feather River Regional Flood Management Plan (May 22, 2014).	This draft Plan was used extensively to inform the entire Flood Management chapter including background and history, infrastructure, and interface with water quality concerns. The response to comments table was issued in May 2014 and was reviewed to determine if any changes to the final draft FRRFMP resulted in edits to the sections that were used in the IRWMP. No edits were noted as the comments either requested additional information or addressed sections not used in the draft Flood Chapter.	Chapter 9 *Flood Management* needs to be updated to add a citation for the Final Draft FRRFMP.
DWR, Central Valley Flood Protection Plan (2011).	Lists several flood projects to be evaluated in Yuba, Sutter, and Butte Counties.	
FEMA, Zone A – Areas subject to inundation maps (2005). Available from: https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1.	These data were used to understand both infrastructure and climate vulnerabilities and to determine data gaps for flooding.	Also used in Climate Change chapter.
Summary Report on Investigations for the Yuba-Feather Supplemental Flood Control Project (Feather River West Levee Project EIS/EIR) (2012).	Stakeholders recommended we review this document. The Sutter Butte Flood Control Agency (SBFCA) is proposing the Feather River West Project (FRWP) to reduce flood risk in the Sutter Basin, which includes a portion of Sutter and Butte Counties. Although data was not cited directly in the IRWMP, the plan was reviewed and taken into consideration as part of preparation of this IRWMP Update.	
YCWA, Flood Management Strategic Plan (2012).	This draft Plan was used to inform the entire Flood Management chapter including background and history, infrastructure, and flood concerns.	
Yuba County Region - Integrated Regional Water Management Plan (2008).	Where appropriate, background information was used from the 2008 IRWMP to inform the Flood Management chapter.	
Natural Resources		
CDFW, Biogeographic Data Branch. California Natural Diversity Database. Sacramento, CA (July 2011). Available from: http://www.dfg.ca.gov/biogeodata/cnddb/.	These data were used to identify sightings and potential habitat for species of special concern as identified by the state and federal governments.	These data are updated, so should be consulted periodically.

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SWRCB, Lower Yuba River Accord (2008).	The Yuba Accord was used extensively to inform the entire natural resources discussion and especially fisheries and environmental water demand.	
Population		
California Department of Finance, Population Projections by Race/Ethnicity for California and Its Counties 2000–2050. Sacramento, CA (May 2012). http://www.dof.ca.gov/research/demographic/reports/projections/p-1/.	These statistical analyses were used to project future population and demographics and, subsequently, water demand and potential land use changes in the Region Description chapter.	These data are updated, so should be consulted periodically.
US Census Bureau, Census 2010. Washington, D.C. (2011). Available from: http://2010.census.gov/2010census/index.php.	Statistical analyses were used to project population and demographics and, subsequently, water demand and potential land use changes.	These data are updated, so should be consulted periodically.
Land Use and Region Description		
Beale Air Force Base, Air Combat Command: Installation Sustainability Assessment Report, 2012.	Identifies water usage and potential savings areas. Used in the Land Use chapter.	
City of Marysville, City of Marysville General Plan (August 1985).	This is a policy document designed to guide the future growth and development of Marysville in a manner consistent with its physical, social, economic, and environmental goals. These documents were reviewed for IRWMP consistency with the city's goals and policies in the Land Use chapter.	
City of Wheatland, General Plan Update Master Water Plan (2006).	Estimates water demands needed to serve the General Plan Update's proposed land uses and identifies the available water sources to serve the GPU demands. Information from this document was incorporated into the Land Use chapter.	
City of Wheatland, Wheatland General Plan: Draft and Final Environmental Impact Report (2006). City of Wheatland, General Plan Background Report (2006). City of Wheatland, Wheatland General Plan Update (2006).	Used for development projections, goals and objectives review, and planning priorities. These city plan updates are policy documents designed to guide the future growth and development of Wheatland in a manner consistent with its physical, social, economic, and environmental goals. These documents were reviewed for IRWMP consistency.	City plans are periodically updated.

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City of Wheatland, Hop Farm Water Supply Assessment (2008). City of Wheatland, Johnson Rancho Water Supply Assessment (2008). Olivehurst Public Utility District, Bear River Project Water Supply Assessment (2006). Olivehurst Public Utility District, Country Club Estates Water Supply Assessment (2007). Olivehurst Public Utility District, Magnolia Ranch Water Supply Assessment (2013).	SB 610 requires certain development projects, including those with more than 500 proposed dwelling units, and projects that will increase residential service connections by more than 10 percent, to prepare a water supply assessment (WSA). The WSA is used by the lead planning agency to determine if a project's water demands will be met by the water purveyor's supplies. Information on area WSAs was incorporated into the Land Use chapter.	
National Marine Fisheries Service, Recovery Plan for the Sacramento River winter-run Chinook salmon, the Central Valley spring-run Chinook salmon, and the California Central Valley steelhead (2014).	The goal of the Recovery Plan is to restore and safeguard the special-status species in the document title to the point where Endangered Species Act (ESA) protections are no longer warranted. The foothills region of the Plan area is listed as a primary reintroduction area in the plan. Information from this document in incorporated into the Land Use chapter.	
Sierra Nevada Forest Plan Amendment (2004).	This plan was reviewed for IRWMP consistency with the goals and objectives. The Sierra Nevada and the Modoc Plateau encompass dozens of complex ecosystems each with numerous, interconnected social, economic, and ecological components. The Sierra Nevada Forest Plan Amendment lays out broad management goals and strategies for addressing five problem areas identified during the planning process: old forest ecosystems and associated species; aquatic, riparian, and meadow ecosystems and associated species; fire and fuels management; noxious weeds; and lower westside hardwood ecosystems.	Forest plans are periodically updated.

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SNEP Science Team and Special Consultants, Summary of the Sierra Nevada ecosystem project report. Centers for Water and Wildland Resources, Davis, CA: University of California (1996).	This report was used to describe how growth in the Yuba County IRWM region will affect the extent of open spaces and cause significant impacts on natural resources.	
SWRCB, Development of Flow Criteria for the Sacramento-San Joaquin Delta (2010).	The purpose of the Flow Criteria is to identify new flow criteria necessary for fish protection in the Sacramento-San Joaquin Delta ecosystem in accordance with the Delta Reform Act of 2009, Water Code Section 85000 et seq. The Flow Criteria do not have any regulatory or adjudicative effect but are used to inform planning decisions for the Delta Plan being prepared by the Delta Stewardship Council and through the collaborative Bay-Delta Conservation Plan effort. Flow Criteria consider and balance all competing uses of water. This document is incorporated into the Land Use chapter.	
USDA, Natural Agricultural Statistics Service, 2007 Census of Agriculture: Yuba County, California.	Used to inform acres of agriculture lost to urbanization.	
US Forest Service, Land and Resource Management Plans for the Plumas and Tahoe National Forests (1990).	These plans describe the current management direction, supply or production capability, existing and projected demands for forest goods and services, and the need or opportunity for changes in current management direction. Applicable resource areas discussed include recreation, fish, wildlife, and sensitive plants, diversity, riparian areas, water, ownership, land uses, and the urban/rural/wildland interface. The plans also discuss how each issue, concern, or opportunity is resolved or addressed during the planning process. The Management Direction chapter presents both forest-wide and area-specific management direction for the TNF. The forest-wide management direction consists of forest goals and desired future conditions, objectives, standards, and guidelines. Information from these plans was presented in the Land Use chapter.	Forest plans are periodically updated.

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YCWA, Dobbins Fire Protection District, and Yuba County Multi-Hazard Mitigation Plans (2007).	Local government agencies and special districts are required to develop and adopt Multi-Hazard Mitigation Plans to be eligible for federal disaster assistance and hazard mitigation grant funds. The goals and strategies of the three area hazard plans are consistent across the documents, with the main purpose being to create a framework for the procedures and projects that will reduce risk and losses in an emergency situation such as wildfire, flooding, or earthquake.	
Yuba County, General Plan Update (2009).	The General Plan was used to identify goals and relevant public policy relative to the distribution of future public and private land use. Planning and land use play a vital role in water use and distribution, and as such will influence infrastructure needs, water demand and supply, and impacts on natural systems addressed in the Plan. Used to inform the percent of land in Yuba County that is now planned for development. Used extensively to describe major land uses in Yuba County and development in various parts of the county.	
Yuba County General Plan Update Background Report: Agriculture (January 2008).	Used to describe percent of various crops in Yuba County.	
Yuba County LAFCO Municipal Services Review and Sphere of Influence Options reports	The Municipal Service Review for Yuba County evaluates services provided by municipal agencies and independent special districts within the county. The districts included in this review are striving to maintain service levels within the changing dynamics of population growth, escalating costs, limited funding, and increasing water demands. Used in the Land Use chapter.	
Yuba County, Draft Parks Master Plan (2008).	Stakeholders recommended we review this reference. Used for recreation development projections, goals and objectives review, and planning priorities. The plan was reviewed and taken into consideration as part of	County plans are periodically updated.

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	preparation of this IRWMP Update, and information from the Parks Master Plan was used in the Land Use chapter.	
Yuba City, Yuba City General Plan (2004).	Used for development projections, goals and objectives review and planning priorities.	City plans are periodically updated.
Yuba County and City of Marysville, Storm Water Management Plan (2004).	The Storm Water Management Plan fulfills the requirements of the National Pollutant Discharge Elimination System (NPDES) Phase II requirements for Small Municipal Separate Storm Sewer Systems. Identifies BMPs, measurable goals, and timetables for the implementation of six minimum control measures required by the US EPA and the State Water Resources Control Board.	
Climate		
AECOM, Final Yuba County General Plan, Environmental Impact Report, Sacramento, CA (May 2011). Available from: http://www.yubavision.org/EIR.aspx	Population trend data, policies addressing GHG emissions and other climate mitigations, and impact assessment from this document were used in the preparation of the climate vulnerability assessment.	Census data and trend projections will change over time. These data were used in the Region Description and Water Supply chapters as well.
California Climate Change Center, Water management adaptation with climate change (paper). Prepared by: Josué Medellin-Azuara, Christina R. Connell, Kaveh Madani, Jay R. Lund, and Richard E. Howitt. Final paper August 2009.	Explores water management adaptation in California using two scenarios: a warm-dry and a warm-only. Modeled findings project consequences that allow separation of precipitation and temperature effects for hydrological adaptation. Specific reference to changes in water supply for the Sacramento basin are relevant to the Yuba County IRWMP, as are segregated analyses of supply for urban vs agricultural use. Used in assessing regional vulnerabilities for urban and agricultural water use and effects on hydropower generation.	The California Energy Commission's PIER Program established the California Climate Change Center in 2003 to document climate research to inform the public and expand climate change information. Likelihood of updated information over time.

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California Department of Water Resources, Managing An Uncertain Future: Climate change adaptation strategies for California's water, Sacramento, CA, State of California (October 2008). Available from: http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf.	Provided a profile of the observed climate phenomena at the state level that have bearing on the region.	
California Energy Commission, Cal-Adapt – Exploring California's Climate Change Research, State of California. Website: http://cal-adapt.org/tools/	Modeled climate trend graphs were accessed for temperature degrees of change, precipitation decadal averages, and wildfire risk, with GIS imaging of all parameters. This information served as another source of comparison with other modeling of the watershed for high and low GHG scenarios.	Less certain because this is modeled data.
California Natural Resources Agency, 2009 California Climate Adaptation Strategy (2009). Retrieved from CAKE: http://www.cakex.org/virtual-library/1959.	Proposes a set of recommendations for policy development to protect the state from the effects of climate change and generally focuses on GHG reduction strategies that were used in the Climate chapter.	
Climate Change Scoping Plan: A framework for change, Prepared by the California Air Resources Board for the State of California, Sacramento, CA (December 2008). Available from: http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf.	Was most relevant when considering adaptive resource management strategies and GHG reduction associated with project development.	
Freeman, G. J., Climate change and California's diminishing low elevation snowpack - a hydroelectric scheduling perspective. Western Snow Conference 71:39-47 (2003). Available from: http://www.westernsnowconference.org/proceedings/pdf_Proceedings/2003%20WEB/Freeman,%20G._Climate%20Change%20and%20CA's%20Diminishing%20Low-Elevatio.pdf	Displays PG&E's early findings on possible impacts to hydropower generation from observed increases in runoff from winter rainfall and concomitant decrease in spring snowmelt. Figures 1-5 in this paper illustrate changes in snow water equivalent, flow ratios, and comparisons of flow for the Yuba drainage. This paper helped with climate trend analyses and vulnerability assessment.	
Freeman, G. J., Runoff impacts of climate change on northern California's watersheds as influenced by geology and elevation– a mountain hydroelectric system perspective. Western Snow Conference 76:23-34 (2008). Available from: http://www.westernsnowconference.org/proceedings/pd	Characterizes the relationship of geology and elevation to groundwater flows in the region, the relationship of groundwater and runoff from reduced snowmelt and their combined effects on runoff trends. It is forecast that climate change will have a relatively large (in comparison	

Table 19-1. A Summary of Primary Studies and Data Sets Used in Preparing the Yuba County IRWMP		
Name of Study/Data Set	**Use in the IRWMP**	**Other (e.g., status of data, certainty of data/analysis, relevance to other sections)**
f_Proceedings/2008/Freeman.RunoffImpactsOfClimateChange OnNorthernCalifornia'sWatersheds.pdf	to more northerly California rivers) timing and quantity change on the Yuba basin because it has a relatively large proportion of exposed granite in its headwaters that limits absorption and recharge. This paper helped with climate trend analyses and vulnerability assessment.	
Freeman, G. J., Tracking the impact of climate change on central and northern California's spring snowmelt subbasin runoff. Western Snow Conference 78:107:118 (2010). Available from: http://www.sierrainstitute.us/ALMANOR/Freeman_Climate_Change_and_Snowmelt.pdf.	Used to examine the influences of and correlation between topography and rain shadow effect on climate impacts to reduced snowmelt, spring runoff, and sometimes total runoff for the water year.	
Freeman, G. J., Analyzing the impact of climate change on monthly river flows in California's Sierra Nevada and Southern Cascade Mountain ranges. Paper presented at Western Snow Conference (2012).	Trend analyses for runoff in the Yuba basin, and related hydrogenation forecasts are offered in this paper. This paper helped with climate trend analyses and vulnerability assessment.	
Lenihan, J.M., et al., The response of vegetation distribution, ecosystem productivity, and fire in California to future climate scenarios simulated by the MC1 dynamic vegetation model. Climate Change 87 (Suppl 1): S215-S230. Output of potential natural vegetation for California (model simulations) (2008). Available from: http://www.enerty.ca.gov/pier/project_reports/500-03-58cf.html.	Analysis of vegetation and effects on vegetation from climate change using modeled data. Used to help inform the climate vulnerability analysis about changing vegetation patterns and related habitat.	Less certain because modeled data were used.
Mehta, V.K., D. E. Rheinheiimer, D.Y. Yates, D.R. Purkey, J.H. Viers, C.A. Young, and J.F. Mount, Potential impacts on hydrology and hydropower production under climate warming of the Sierra Nevada. Journal of Water and Climate Change (2011).	The Water Evaluation and Planning (WEAP) model was applied to the Cosumnes, American, Bear, and Yuba (CABY) region to simulate climate impacts on hydropower generation. The authors found that all four watersheds responded to climate warming with corresponding increases in wet season flows, decreases in dry season flows, and a net annual decrease in flow overall. This paper helped with climate trend analyses and vulnerability assessment.	

Table 19-1. A Summary of Primary Studies and Data Sets Used in Preparing the Yuba County IRWMP		
Name of Study/Data Set	**Use in the IRWMP**	**Other (e.g., status of data, certainty of data/analysis, relevance to other sections)**
Natural Resources Agency, Department of Water Resources, Division of Integrated Regional Water Management, Proposition 84 & Proposition 1E Integrated Regional Water Management Guidelines, Sacramento, CA; State of California. (November 2012). Available from: http://www.water.ca.gov/irwm/guidelines.cfm.	Guidance for the Plan on aspects of climate to be discussed, strategies to be considered, and assessment of GHG emissions.	Guidance for all Plan sections.
Office of Emergency Services, Yuba County Multi-Jurisdictional Multi-Hazard Mitigation Plan, Yuba County, CA (2009). Available from: http://www.co.yuba.ca.us/departments/OES/PDM/Multi-hazard%20mitigation%20plan/Plan%20Documents/Section%204%20-%20Risk%20Assessment.pdf	This Plan, developed with stakeholder and community assistance, makes a risk assessment of both natural and human-caused hazards within Yuba County. It includes discussion of probability, a vulnerability assessment, loss estimates, and the impact of future county development. Climate change is one of the hazards discussed, both directly and indirectly (e.g., it is discussed indirectly via severity of winter storms and flood hazard). This helped with climate trends analyses and vulnerability assessment.	Also used in Land Use chapter.
Safford, H.D., M. North, and M.D. Meyer, Chapter 3: Climate Change and the Relevance of Historical Forest Conditions, Managing Sierra Nevada Forests, Albany, CA: US Department of Agriculture, Forest Service, Pacific Southwest Research Stations. No date. Available from: http://www.fs.fed.us/psw/publications/documents/psw_gtr237/psw_gtr237_023.pdf	Broad application of data from this study helped define regional climate trends and vulnerabilities/strategies	
US Environmental Protection Agency, CA Department of Water Resources, US Army Corps of Engineers, and the Resource Legacy Fund, Climate Change Handbook for Regional Water Planning (December 2011). Available from: http://www.water.ca.gov/climatechange/docs/Climate_Change_Handbook_Regional_Water_Planning.pdf	The climate checklist was populated where relevant, was applied to and populated with localized data by the project team and the Core Group to inform the climate vulnerabilities and adaptations section.	
World Resources Institute, The Greenhouse Gas Protocol: Designing a Customized Greenhouse Gas Calculation Tool (June 2006). Available from: http://pdf.wri.org/GHGProtocol-Tools.pdf	Provided the formulae used to calculate GHG emissions from Tier 1 projects.	

Table 19-1. A Summary of Primary Studies and Data Sets Used in Preparing the Yuba County IRWMP		
Name of Study/Data Set	**Use in the IRWMP**	**Other (e.g., status of data, certainty of data/analysis, relevance to other sections)**
Yuba County Water Agency, Groundwater Management Plan (December 2010).	The Groundwater Management Plan addresses groundwater basin conditions through spring 2010. It provides the status of management activities in the basin and presents a list of groundwater management actions to implement Plan goals. This Plan helped array adaptive strategies for groundwater management in the face of climate stressors, and data gaps for water management.	This is an update of the 2005 GWMP. Also used in the Land Use chapter.
US Environmental Protection Agency, The Emissions & Generation Resource Integrated Database for 2010: (Egrid2010) Technical Support Document. Prepared by: E.H. Pechan & Associates, Inc., (December 2010). Available from: http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2010TechnicalSupportDocument.pdf	Used to calculate construction-related electric energy use emissions.	

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