Upper Feather River Integrated Regional Water Management Plan Update 2016

November 2016

Submitted to: Department of Water Resources

Submitted by: Upper Feather River Regional Water Management Group

Upper Feather River

Integrated Regional Water Management

Plan Update 2016

November 2016

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Plumas County Flood Control and Water Conservation District
(DWR Grant Agreement No. 4600010066)

Prepared by:
Uma Hinman Consulting

With leadership, direction and approval by:
Upper Feather River Regional Water Management Group and Stakeholders of the Upper Feather River Watershed

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Between 2014 and 2016, the stakeholders and water managers of the Upper Feather River watershed worked together to develop an Integrated Regional Water Management Plan. Funded by the California Department of Water Resources through Proposition 84 (Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006), this planning effort was funded through a grant awarded to Plumas County Flood Control and Water Conservation District. Additional funding support was in the form of matching funds through watershed planning efforts, primarily from Plumas County.

Thank you to all regional participants who participated in this planning effort. The Plan owes its success to the time they invested and the expertise they provided over this more than two-year period. The relationships developed and strengthened through the planning process will continue to benefit the Upper Feather River region for years to come.

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The organizations and individuals listed below saw the Plan update to fruition. The status of these entities may change and membership may grow in the future.

Regional Water Management Group (RWMG)

The authors thank the members of the Upper Feather River Regional Water Management Group:

Plumas County Flood Control and Water Conservation District, Sharon Thrall (Chair)
County of Sierra, Paul Roen (Vice-Chair)
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IRWM Plan Process Design and Facilitation Team

Preparation of the Upper Feather River Integrated Regional Water Management Plan was coordinated by Uma Hinman Consulting and a team of local and regional subconsultants. The Plan was prepared in accordance with the California Department of Water Resources' November 2012 and August 2016 IRWM Planning Guidelines, and per the instructions and preferences of the RWMG and stakeholders.

The following firms and individuals comprised the team led by Uma Hinman Consulting:

Uma Hinman Consulting: Project Coordinator, process development, public outreach and RWMG meeting facilitator, Municipal Services Workgroup Coordinator, technical writer.

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Michael Baker International: Prepared the climate change vulnerability analysis and chapter, developed project-specific climate change and greenhouse gas emission analyses tools.

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Sierra Institute for Community and Environment: Prepared the Socioeconomic Assessment of the Upper Feather River Region.

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Trina Cunningham: Tribal Advisory Committee Coordinator, disadvantaged community outreach and surveys.

Tamara Watson: Grant reporting and invoicing.

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Acronym	Meaning
AB	Assembly Bill
AB 2838	Cortese-Knox-Hertzberg Act
ACS	American Community Survey
AF	Acre-feet
ALS	Agricultural Land Stewardship Workgroup
AOP	Aquatic Organism Passage
AUM	Animal Units per Month
AWMP	Agricultural Water Management Plans
Basin Plan	Water Quality Control Plan
BMP	Best Management Practices
CABY	Cosumnes-American-Bear-Yuba Integrated Regional Water Management Region
Cal-Adapt	Online database maintained by CEC, CNRA, and PIER
CARB	California Air Resources Board
CASGEM	California Statewide Groundwater Elevation Monitoring
CCFC	California Financing Coordinating Committee
CCSM3	Cal-Adapt's Community Climate System Model 3.0
CDEC	California Data Exchange Center
CDFW	California Department of Fish and Wildlife
CEC	California Energy Commission
CEDEN	California Environmental Data Exchange Network
CEQA	California Environmental Quality Act
CFCC	California Financing Coordinating Committee
CIEA	California Indian Environmental Alliance
CIMIS	California Irrigation Management Information System
CNDDB	California Natural Diversity Database
CNRA	California Natural Resources Agency
CO2	Carbon Eioxide
CRS	Community Rating System
CSA	Community Service Area
CSD	Community Services District
CVFPP	Central Valley Flood Protection Program
CVRWQCB	Central Valley Regional Water Quality Control Board
CWC	California Water Code
CWP	California Water Plan
CWSRF	Clean Water State Revolving Fund
DAC	Disadvantaged Communities
DAU	Detailed Analysis Unit

Acronym	Meaning
DMMs	Demand Management Measures
DMS	Data Management Standard
DO	Dissolved Oxygen
DWR	Department of Water Resources
DWSRF	Drinking Water State Revolving Fund
EDA	Economically Disadvantaged Area
EIR	Environmental Impact Report
EJ	Environmental justice
EPA	Environmental Protection Agency
ERC	Ecological Resources Committee
FAAST	Financial Assistance Application Submittal Tool
FCWDC	Flood Control and Water Conservation District
FEMA	Federal Emergency Management Act
FERC	Federal Energy Regulatory Commission
FIRM	Federal Insurance Rate Mapping
FMA	Mitigation Assistance Program
FMW	Floodplains, Meadows, Waterbodies Workgroup
FRCRM	Feather River Coordinated Resource Management
FRLT	Feather River Land Trust
GAMA	Groundwater Ambient Monitoring and Assessment Program
GHG	Greenhouse Gas
GIS	Geographical Information Systems
GLCSD	Grizzly Lake Community Services District
GSP	Groundwater Sustainability Plan
GWMP	Groundwater Management Plan
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
ILRP	Irrigated Lands Regulatory Program
IPCC	Intergovernmental Panel on Climate Change
IRWM	Integrated Regional Water Management
IRWMP	Integrated Regional Water Management Plan
IWM	Integrated Water Management
IWRIS	Integrated Water Resources Information System
LAFCo	Local Agency Formation Commission
LEPA	Low Energy Precision Application
MAF	Million Acre-Feet
MCL	Maximum Contaminant Level
MHI	Median household income
MOU	Memorandum of Understanding

Acronym	Meaning
MS	Municipal Services Workgroup
MSR	Municipal Service Review
NEPA	National Environmental Policy Act
NGO	Non-Government Agency
NMFS	National Marine Fisheries Services
NPDES	National Pollutant Discharge Elimination System
NPO	Non-Profit Organization
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NRWA	National Rural Water Association
NSVIRM	Northern Sacramento Valley Integrated Regional Water Management Region
O&M	Operations and Maintenance
OES	Office of Emergency Services
OHMVR	Off-Highway Motor Vehicle Recreation Commission Program
PCBs	Polychlorinated Biphenyls
PDM	Disaster Mitigation Program
PECSD	Plumas-Eureka Community Services District
PG&E	Pacific Gas & Electric Company
PIER	Public Interest energy Research Program
PIF	Project Information Form
PSMP	Project-Specific Monitoring Plan
PSREC	Plumas-Sierra Rural Electric Co-op
PUD	Public Utility District
PWF	Plumas Watershed Forum
RAC	Resource Advisory Committees
RAP	Regional Acceptance Process
RCD	Resource Conservation District
RMS	Resource Management Strategies
RTCA	Rivers, Trails, and Conservation Assistance Program
RWMG	Regional Water Management Group
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SFWPA	South Feather Water & Power Agency
SGP	Sustainable Groundwater Plan
SIP	Stakeholder Involvement Plan
SIR	Susanville Indian Rancheria
SLR	Sea Level Rise
SRA	State Responsibility Area

Acronym	Meaning
SRF	State Revolving Fund
SVGMD	Sierra Valley Groundwater Management District
SVRCD	Sierra Valley Resource Conservation District
SWAMP	Surface Water Ambient Monitoring Program
SWIM	Sacramento River Watershed Information Module
SWP	State Water Project
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
SWRP	Storm Water Resource Plan
TAC	Tribal Advisory Committee
TEK	Traditional Ecological Knowledge
TEP	Tribal Engagement Plan
TMDL	Total Maximum Daily Load
UFR	Upper Feather River
UNFRHP	Upper North Fork Feather River Hydroelectric Project
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
UWMP	Urban Water Management Plan
WDL	Water Data Library
WDR	Waste Discharge Requirements
WRP	Wetland Reserve Program
WSA	Water Supply Assessment
WUI	Wildland-Urban Interface

CHAPTER 1.0 INTRODUCTION

1.1 Background

The Upper Feather River Region has a long history of successful watershed planning and implementation. In 2005, with the advent of the State of California's Integrated Regional Water Management (IRWM) Program, water managers in the Region embraced the process as a means to integrate the various watershed efforts and encourage greater implementation and transparency. The 2005 IRWM planning effort was built on the communication and cooperation that took place for decades on such topics as natural resources enhancement, management for special status species, watershed and forest management on national forests, several Federal Energy Regulatory Commission (FERC) relicensing processes, State Water Project financing and management issues, and many other topics. This 2016 IRWM Plan incorporates the strengths and synergies from those historic efforts and identifies new opportunities for collaboration on current and future regional water management issues and perspectives developed from extensive outreach and public engagement with a broad array of water stakeholders and interests.

This IRWM Plan articulates a coherent and durable vision for the management of water resources in the Upper Feather River (UFR) Region that highlights important actions needed to accomplish that vision through the year 2035--the planning horizon. This document is intended to be an ongoing adaptive planning tool that can evolve with a dynamic water future. It does not authorize or provide discretionary approval for any given project, nor does it establish new prescriptive compliance requirements. Rather, it provides a locally developed framework for improving understanding and undertaking the coordinated actions that will be needed to address the major water-related challenges/needs and conflicts facing the Region through the planning horizon.

This 2016 IRWM Plan, which is an update to the 2005 Upper Feather River Watershed IRWM Plan, is required to be in compliance with 2012 IRWM Grant Program Guidelines (Proposition 84, DWR 2006a) and 1E (DWR 2006b) per the Proposition 84 Planning Grant). It is also intended to comply with the 2016 IRWM Grant Program Guidelines (Proposition 1) (DWR 2016) published by the California Department of Water Resources (DWR) in August 2016. The information contained within this IRWM Plan was developed through the time, expertise, and other contributions of more than 40 water supply, wastewater treatment, land use management, Tribal, public interest, and including some of the ecosystem-focused, non-governmental organizations with interests in the water resources of the Upper Feather River Region. The focus and direction described within this IRWM Plan provides participating entities and individuals with an opportunity to envision the integration of water management across the Region and thereby accomplish more to benefit the needs of the Region. The integrated array of goals and objectives, resource management strategies (RMS), implementation projects, and the Plan's implementation framework demonstrate the potential for further strengthening and broadening the collaborative working relationships for integrated water and watershed management that have been fostered throughout the 24-month plan development process.

1.2 History, Purpose, and Status of the California IRWM Program

Integrated Water Management (IWM) is a strategic approach to planning and implementing water management programs that combines flood management, environmental stewardship, and surface water and groundwater supply actions to deliver multiple benefits across watershed and jurisdictional boundaries.

Per DWR guidelines and the California Water Code (DWR 2016a), an IRMW Plan is a comprehensive planning document to encourage regional strategies for management of water resources. By investigating a broad spectrum of issues, developing objectives, and identifying management strategies, participants develop relationships and methods of communication and coordination that achieve synergies of staff and financial resources, making planning more comprehensive and less duplicative throughout the planning region. This process should result in a water management plan that is meaningful for the region and developed collaboratively, accommodating a diversity of regional needs.

State-level water managers in California began to recognize the need for local- and regional-scale water planning in the late 1990s. With the enactment of Senate Bill (SB) 1672, the Integrated Regional Water Management Planning Act of 2002, the State of California affirmed the importance of IRWM. In this act, the legislature found and declared:

> *"(a) Water is a valuable natural resource in California, and should be managed to ensure the availability of sufficient supplies to meet the state's agricultural, domestic, industrial, and environmental needs. It is the intent of the Legislature to encourage local agencies to work cooperatively to manage their available local and imported water supplies to improve the quality, quantity, and reliability of those supplies.*
>
> *(b) Improved coordination among local agencies with responsibilities for managing water supplies and additional study of groundwater resources are necessary to maximize the quality and quantity of water available to meet the state's agricultural, domestic, industrial, and environmental needs.*
>
> *(c) The implementation of the Integrated Regional Water Management Planning Act of 2002 will facilitate the development of integrated regional water management plans, thereby maximizing the quality and quantity of water available to meet the state's water needs by providing a framework for local agencies to integrate programs and projects that protect and enhance regional water supplies."*

The 2002 Act authorized regional water management groups to prepare and adopt a regional plan that addresses programs, projects, reports, or studies relating to water supply, water quality, flood protection, or related matters, over which any local public agency, that is a participant in that group, has authority to undertake.

The 2005 California Water Plan featured IRWM as its "Number 1 Initiative," described its implementation as essential to the state's future, and listed the following IRWM principles:

- Use a broad, long-term perspective,
- Identify broad benefits, costs, and trade-offs,
- Promote sustainable resource management,
- Increase regional self-sufficiency,
- Increase regional drought preparedness,
- Use open forums that include all communities,
- Promote coordination and collaboration among local agencies and governments, and
- Use sound science, best data, and local knowledge.

In the Implementation Plan of the California Water Plan (CWP) Update 2009, the first objective listed is to "promote, improve, and expand integrated regional water management to create and build on partnerships that are essential for California water resources planning, sustainable watershed and floodplain management, and increasing regional self-sufficiency." Integrated water management and

IRWM practices have made strides over the past ten years, and the California Water Plan Update 2013 encouraged continuation and expansion of these practices. The CWP Update 2013 identified an action to increase regional self-reliance and IRWM across all levels of government.

California voters similarly affirmed the importance of these efforts via passage of four significant bond measures (Table 1-1):

Table 1-1 Voter-approved Bond Measures – Integrated Water Management

Year	Name	IRWM Program Apportionment	UFR Awards
2002	Proposition 50: The Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002	$500 million	$7 million for implementation projects
2006	Proposition 84: The Safe Drinking Water, Water Quality, and Supply, Flood Control, River and Coastal Protection Bond Act	$1 billion	$679,000 for planning (to update the 2005 IRWM Plan)
2006	Proposition 1E: The Disaster Preparedness and Flood Prevention Bond Act	$300 million	None
2014	Proposition 1: The Water Quality, Supply, and Infrastructure Improvement Act of 2014	$510 million	In process

In 2002, voters passed Proposition 50 (DWR 2004a), which developed the Integrated Regional Water Management Grant Program as a joint effort between the California Department of Water Resources and the State Water Resources Control Board (SWRCB). Proposition 50 provided competitive grant funding through the IRWM Program for projects that protected communities from drought, protected and improved water quality, and reduced dependence on imported water. Approximately $380 million was made available through two rounds of funding.

Subsequently, voters passed Proposition 84 (DWR 2006a) and Proposition 1E (DWR 2006b) in 2006. These propositions created additional funding through the IRWM Grant Program for projects that assist local agencies to meet the long-term water needs of the state, including delivery of safe drinking water and protection of water quality and the environment. To be eligible for this funding, projects and project sponsors must be involved in a Regional Water Management Group (RWMG) that has adopted an IRWM Plan.

Most recently, voters passed Proposition 1, which enacted the Water Quality, Supply, and Infrastructure Act of 2014 (DWR 2014a). Proposition 1 authorized funding for implementation, planning, and disadvantaged community (DAC) involvement efforts to each IRWM Funding area (DWR 2014b). Proposition 1 provides funding for projects that help meet the state's long-term needs, including:

- To assist adaptation of water infrastructure systems to climate change.
- To provide incentives throughout each watershed to collaborate in managing the region's water resources and setting regional priorities for water infrastructure.
- To improve regional water self-reliance, while reducing reliance on the Sacramento-San Joaquin Delta.

1.3 Purpose and Vision

The IRWM Program is intended to promote and implement integrated regional water management to ensure sustainable water uses, reliable water supplies, improved water quality, environmental stewardship, efficient urban development, sustainable agriculture, and a strong economy. This planning and implementation framework is a strategic approach to planning and implementing water management programs that combines flood management, environmental stewardship, and water supply actions to deliver multiple economic, environmental, and social benefits across watershed and jurisdictional boundaries (DWR 2013a). It implements integrated solutions through a collaborative multi-partner process that includes water managers; Native American tribes; non-governmental organizations; federal, state, and local government agencies; and DACs. IRWM is a portfolio approach for determining the appropriate mix of water-related resource management strategies, and investments for projects that enhance environmental and watershed stewardship across the planning region. The goal of the Plan is to provide a coordinated and comprehensive framework for achieving reliable, durable, affordable, and high-quality water supplies for water uses and needs in the UFR region.

As the result of this collaborative regional planning effort, this 2016 UFR IRWM Plan is intended to be useful as a "living" document to guide adaptive management and implementation within the Region. It is both the continuation of regional watershed restoration and management efforts and also the enhancement of collaborative and inclusive processes that participants expect to follow moving forward. During its November 14, 2014 meeting, the RWMG unanimously approved a mission statement to guide the actions of the UFR IRWM Program, spell out its overall goal, provide a path, and guide decision-making for the RWMG.

Upper Feather River RWMG Mission

To effectively perpetuate local control and regional collaboration to provide stability and consistency in the planning, management and coordination of resources within the Upper Feather River Watershed. To implement an integrated strategy that guides the Upper Feather River region toward protecting, managing and developing reliable and sustainable water resources. (November 14, 2014)

Stakeholders have voiced the need for ongoing dialogue as water resource projects are proposed and implemented; for further developing communication pathways to address regulatory issues; for speaking with a regional voice when needed about resource issues of federal and state importance; and to continue to rely upon and strengthen local and regional knowledge, experience, and capacity to accomplish objectives identified in this Plan. As part of this commitment, RWMG members have committed to meet at least quarterly to assess Plan implementation, to track and accelerate progress in implementing projects, to identify and communicate "lessons learned" in advancing integrated water and watershed management, and to identify and broaden funding opportunities.

1.4 Regional and Statewide Priorities for IRWM Program

The DWR's IRWM Grant Program encourages development of integrated regional strategies for management of water resources by providing funding through competitive grants. Eligible projects must implement IRWM plans that meet the requirements of Propositions 84 and 1. As required, IRWM plans should identify and address the major water-related objectives and conflicts within the region, consider all RMSs identified in the California Water Plan Update, and use an integrated, multi-benefit approach for project selection and design. Plans should include performance measures and monitoring plans to document progress toward meeting Plan objectives. Projects that may be funded must be consistent with an adopted IRWM plan or its functional equivalent as defined in DWR's Propositions 84 and 1 IRWM guidelines.

In addition to addressing regional issues (Chapter 4 *Regional Water Issues, Integration, Capacity*), the DWR guidelines identified multiple priorities that address issues of statewide concern (Table 1-2).

Table 1-2 Statewide Priorities, Proposition 1 Guidelines

Action No.	Action	Description
1	Make conservation a way of life	Building on current water conservation efforts and promoting the innovation of new systems for increased water conservation. ♦ Expand agricultural and urban water conservation and efficiency to exceed Senate Bill (SB) X7-7 targets ♦ Provide funding for conservation and efficiency ♦ Increase water sector energy efficiency and greenhouse gas reduction capacity ♦ Promote local urban conservation ordinances and programs
2	Increase regional self-reliance and integrated water management across all levels of government	Ensure water security at the local level, where individual governmental efforts integrate into one combined regional committee where the sum becomes greater than any single part. ♦ Support and expand funding for integrated water management planning ♦ Update land use planning guidelines ♦ Provide assistance to disadvantaged communities ♦ Encourage California's focus on projects with multiple benefits ♦ Increase the use of recycled water
3	Achieve the co-equal goals of the Delta	This action is directed towards state and federal agencies; however, consideration will be afforded to eligible local or regional projects that also support achieving the co-equal goals providing a more reliable water supply for California and to protect, restore, and enhance the Delta ecosystem

Action No.	Action	Description
4	Protect and restore important ecosystems	Continue protecting and restoring the resiliency of our ecosystems to support fish and wildlife populations, improve water quality, and restore natural system functions: ♦ Restore key mountain meadow habitat ♦ Manage headwaters for multiple benefits ♦ Protect key habitat of the Salton Sea through local partnership ♦ Restore coastal watersheds ♦ Continue restoration efforts in the Tahoe Basin ♦ Continue restoration efforts in the Klamath Basin ♦ Water for wetlands and waterfowl ♦ Eliminate barriers to fish migration ♦ Assess fish passage at large dams ♦ Enhance water flows in stream systems statewide
5	Manage and prepare for dry periods	Effectively manage water resources through all hydrologic conditions to reduce impacts of shortages and lessen costs of state response actions. Secure more reliable water supplies and consequently improve drought preparedness and make California's water system more resilient. ♦ Revise operations to respond to extreme conditions
6	Expand water storage capacity and improve groundwater management	Increase water storage for widespread public and environmental benefits, especially in increasingly dry years, and better manage our groundwater to reduce overdraft. ♦ Provide essential data to enable sustainable groundwater management ♦ Support funding partnerships for storage projects ♦ Improve sustainable groundwater management ♦ Support distributed groundwater storage ♦ Increase statewide groundwater recharge ♦ Accelerate cleanup of contaminated groundwater and prevent future contamination

Action No.	Action	Description
7	Provide safe water for all communities	Provide all Californians the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes. ♦ Consolidate water quality programs ♦ Provide funding assistance for vulnerable communities ♦ Manage the supply status of community water systems Additionally, as required by Water Code Section 10545, in areas that have nitrate, arsenic, perchlorate, or hexavalent chromium contamination, consideration will be given to grant proposals that included projects to help address the impacts caused by those contaminants, including projects that provide safe drinking water to small disadvantaged communities.
8	Increase flood protection	Collaboratively plan for integrated flood and water management systems, and improve flood projects that protect public safety, increase water supply reliability, conserve farmlands, and restore ecosystems. ♦ Improve access to emergency funds ♦ Better coordinate flood response operations ♦ Prioritize funding to reduce flood risk and improve flood response ♦ Encourage flood projects that plan for climate change and achieve multiple benefits
9	Increase operation and regulatory efficiency	This action is directed toward state and federal agencies; however, consideration will be afforded to eligible local or regional projects that also support increased operational efficiency of the State Water Project or Central Valley Project.
10	Identify sustainable and integrated financing opportunities	This action is directed toward state agencies and the legislature.

1.5 Upper Feather River Planning Process

In 2005, an initial regional water management group was organized under the guidelines of the Proposition 50 phase of the IRWM Program, consisting of Plumas County, Plumas County Flood Control and Water Conservation District, Plumas National Forest, and Sierra Valley Groundwater Management District. The collaboration built upon the past cooperation among the Feather River Coordinated Resource Management (DWR 2009a) group, the Plumas Watershed Forum (Plumas County 2009), and other existing programs and plans in the region. The 2005 UFR IRWM Plan focused on documenting the existing water management authorities and accomplishments, and identifying gaps in the following existing regional plans:

- Feather River Coordinated Resource Management MOU
- Feather River Watershed Management Strategy
- FERC Project 1962 Settlement Agreement
- FERC Project 2105 Settlement Agreement
- Herger-Feinstein Quincy Library Group Forest Recovery Act
- Monterey Settlement Agreement
- Plumas National Forest Land and Resource Management Plan
- Sierra Valley Groundwater Management District Act

The Upper Feather River RWMG was reorganized in 2008 to create a more formal governance structure to increase stakeholder participation, collaboration, and opportunities in order to meet requirements of the IRWM Planning Act of 2008 (Proposition 84). In 2009, the RWMG sought approval of the UFR Region from DWR through the Region Acceptance Process (RAP), which was prepared by the Plumas County Flood Control and Water Conservation District, and a new memorandum of understanding (MOU) with 29 signatories was established. The intent of the new MOU was to recognize relationships and to formalize commitments to working together to promote regional water management planning for the Upper Feather River watershed. The MOU signatories agreed to participate in a long-term effort to better understand the water resources in the watershed, and to design a voluntary and collaborative approach for managing those resources that recognizes the competing needs for water in the future and the long history of water and land stewardship in the region.

In developing the RAP documents, the organizations were in contact with representatives of the newly approved Upper Feather River IRWM Region and the Northern Sacramento Valley Region to ensure that the UFR covered all areas of the Upper Feather River watershed down to Oroville Dam, and had congruent regional boundaries with surrounding regions. The exception was an area of overlap with the Northern Sacramento Valley IRWM Region, which consists of the Butte County area around Lake Oroville. It was determined that this area was relevant to both IRWM regions; the overlap acknowledged a need for coordination between the two IRWMs. Plumas County submitted the RAP on behalf of the Upper Feather River region in 2009, which was ultimately accepted, thereby establishing the Upper Feather River IRWM Region. In 2012, the Plumas County Flood Control and Water Conservation District developed the planning grant proposal, which was awarded in 2014.

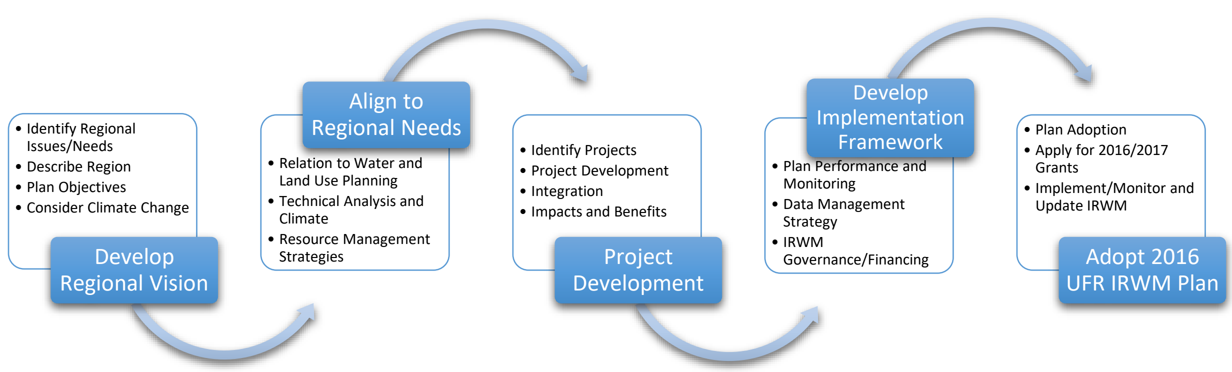
In mid-2014, the Plumas County Flood Control and Water Conservation District signed a two-year grant agreement with DWR to manage the process of developing an IRWM Plan for the Upper Feather River Region. The planning process is designed to develop a water management plan that is meaningful for the region--developed by the stakeholders, rather than a top down, one-size-fits-all approach--to accommodate the diverse needs of different interests. A revised MOU was developed and circulated in late 2014 that recognized the changes in the Region’s governance structure that was identified in the grant agreement work plan. To date, 36 agencies, stakeholders, and entities within the Region have signed the MOU.

Much of the groundwork for the IRWM planning effort in the region had already been initiated through the work of other collaborative processes such as the Upper Feather River Watershed Group, Quincy Library Group, Plumas Watershed Forum, Feather River Coordinated Resource Management group, Feather River Roundtable, Maidu Consortium, Mountain Meadows Conservancy, Lake Almanor Watershed Group, Plumas Corporation, and the FERC relicensing Settlement Agreement development processes, all of which serve as building blocks for integrated regional water management. In the North Fork Feather River watershed, diverse stakeholders have been involved in FERC relicensing processes with PG&E and State Water project facilities. In the Middle Fork of the Feather River, local groundwater management governance was initiated through state legislation developed by Sierra Valley agricultural water users and Sierra and Plumas Counties.

In September 2014, Plumas County Flood Control and Water Conservation District sent a letter to the 29 RAP MOU signatories to initiate the Plan Update process and invited them to the first meeting of the RWMG, which was held on September 24, 2014. Additionally, informational articles were posted in the newspaper, inviting stakeholders and interested parties to the first RWMG meeting. Furthermore, a Notice of Intent was published in the local newspapers in early October (Appendix 1-3). Tribal, disadvantaged community (DAC), and National Forest representatives from the three National Forests in the region, were invited to participate in the Plan update as members of the Regional Water Management Group (RWMG).

As the UFR IRWM Plan Update planning process got underway in 2014, the RWMG held meetings every other month. This schedule encouraged continuous discussion, while allowing time for the project workgroups to respond to requests and develop meeting materials. In mid-2015, after most of the chapter work had been discussed within the stakeholder meetings, many details had been worked out by workgroups dedicated to four key areas of interest in the region: agricultural lands stewardship; floodplains, meadows, waterbodies; municipal services; and uplands and forest. Additionally, a Tribal Advisory Committee (TAC) met and worked in parallel with the workgroups. The workgroups and TAC were integral in the development of the majority of information and materials for the Plan Update. For example, the workgroups identified regional issues, developed recommendations for RMSs, developed implementation projects, provided input on climate change vulnerabilities and adaptation strategies, identified integration linkages, and reviewed and provided input on chapters. These workgroups allowed for continued and open participation, which was instrumental during the development of a comprehensive UFR IRWM Plan.

Figure 1-1 IRWM Planning Process Overview



1.5.1 Plan Organization

The 2016 Upper Feather Region IRWM Plan Update provides a description of the Region; identifies regional issues, challenges, and opportunities; and details how they inform the objectives for the Region. The Plan is organized to address the standards required by the Proposition 84 and 1 IRWM guidelines issued by DWR. Table 1-3 links DWR plan elements with the Upper Feather River IRWM Plan chapters.

Table 1-3 Proposition 84 and 1 standards discussed in the 2016 UFR IRWM Plan Update

IRWM Standard	IRWM Plan Chapter
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1.5.2 Plan Adoption

It is recommended that all participants in the planning process, including the governing boards of the RWMG, adopt the 2016 Upper Feather River Integrated Regional Water Management Plan. The IRWM guidelines require that each agency that is part of the RWMG be responsible for the development and implementation of the Plan and formally adopt the IRWM Plan. The guidelines also require that each project proponent named in an IRWM Grant Application adopt the Plan.

It is anticipated that the governing bodies of the various public agencies will begin to adopt the Plan once the final IRWM Plan is released in late 2016 (see Appendix 1-1 for RWMG Resolution of Plan Adoption). A list of organizations that have adopted or endorsed the UFR IRWM Plan will be included on the website. Adoption or endorsement of the UFR IRWM Plan does not imply that an organization necessarily supports every project that is included in the Plan. Rather, each organization is documenting its support for the objectives, resource management strategies, actions, and the implementation framework recommended to implement the Plan. Projects will be reviewed for implementation on a case-by-case basis as the Plan is implemented.

CHAPTER 2.0 GOVERNANCE, STAKEHOLDER INVOLVEMENT, COORDINATION

2.1 Introduction

This chapter describes the governance and stakeholder outreach process and procedures that will be followed during the update and implementation of the Upper Feather River (UFR) Integrated Regional Water Management (IRWM) Plan. Ensuring effective governance of the IRWM Plan process facilitates access by all stakeholders as well as the public to the planning process. The goal of governance, stakeholder involvement, and coordination is to provide multiple and continued opportunities for participation and comment throughout the planning process, and to continue to encourage public engagement in regional water management after the Plan is adopted. The Upper Feather River IRWM values Traditional Ecological Knowledge (TEK) and is working to integrate these values into each project.

2.2 Governance

2.2.1 Memoranda of Understanding and Entities Adopting the UFR IRWM Plan

In June 2005, the County of Plumas, the Plumas County Flood Control and Water Conservation District, the Sierra Valley Groundwater Management District (SVGMD), and the United States Forest Service Plumas National Forest entered into a Memorandum of Understanding (MOU) to adopt an initial IRWM Plan for the UFR Watershed. These entities, collectively known as the Feather River Regional Watershed Initiative, collaborated in the development of a UFR IRWM Plan under California Department of Water Resources Proposition 50 Guidelines and Standards (DWR 2004a). The primary goals were to increase coordination and collaboration among stakeholders in the UFR Watershed and to ensure that an appropriate share of IRWM funding available to the Sacramento River funding area would be allocated to the UFR Watershed[1]. The parties also were seeking to ensure that objectives, data and project outcomes for the UFR Watershed were incorporated into state and regional plans:

- State Water Plan, as revised every five years by the Department of Water Resources (DWR);
- Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin River Basins;
- Hydroelectric licenses and adaptive management processes of the Federal Energy Regulatory Commission (FERC); and
- California Air Resources Board Scoping Plan (AB 32).

In order to remain eligible for DWR's IRWM grant funding opportunities, it is necessary to update the existing UFR IRWM Plan to Proposition 84 standards (DWR 2006a). Consequently, to encourage increased collaboration throughout the region and to further define the intent of the UFR IRWM Program, a subsequent MOU was signed in November 2014 (Appendix 2-1), which established the Upper Feather River Regional Water Management Group (RWMG) as the successor to the 2005 Feather River Regional Watershed Initiative. As required by the IRWM Act (California Water Code Sections 10530 to 10547), the formation of the RWMG is necessary to carry out the UFR IRWM Program and further to develop, implement, and periodically update the UFR IRWM Plan. In addition to carrying out the Program, the RWMG is required to:

[1] The region was successful in obtaining subsequent Proposition 50 grant funds amounting to approximately $7 million (allocated in 2008 and amended in 2015).

- Support the objectives of the California Department of Water Resources IRWM Program that seeks to ensure sustainable water uses, reliable water supplies, better water quality, environmental stewardship, efficient development, protection of agriculture, and strong economies.
- Promote communication and collaboration in the Upper Feather River Region to identify and implement resource management strategies and projects with broad-based stakeholder support.
- Facilitate investment partnerships in projects that can maximize regional benefits through economies of scale and through projects with multiple resource benefits and beneficiaries.
- Refine values for ecosystem services that are provided through water and watershed management actions.
- Develop investment opportunities for increasing financial support from extra-regional beneficiaries of improvements in water supply, water quality, flood control, hydroelectric generation, recreational opportunities, forest health, habitat and species preservation, and carbon sequestration, etc.
- Facilitate communication and coordinated actions among the regional stakeholders.
- Coordinate planning and actions with neighboring or otherwise connected IRWM Regions.

The MOU also encourages California state agencies--the Department of Water Resources, the Central Valley Regional Water Quality Control Board, the Department of Conservation, and the Department of Fish and Wildlife--to designate liaisons in order to promote coordination with State plans and actions with the work of the UFR RWMG.

2.3 Plan Governance Structure

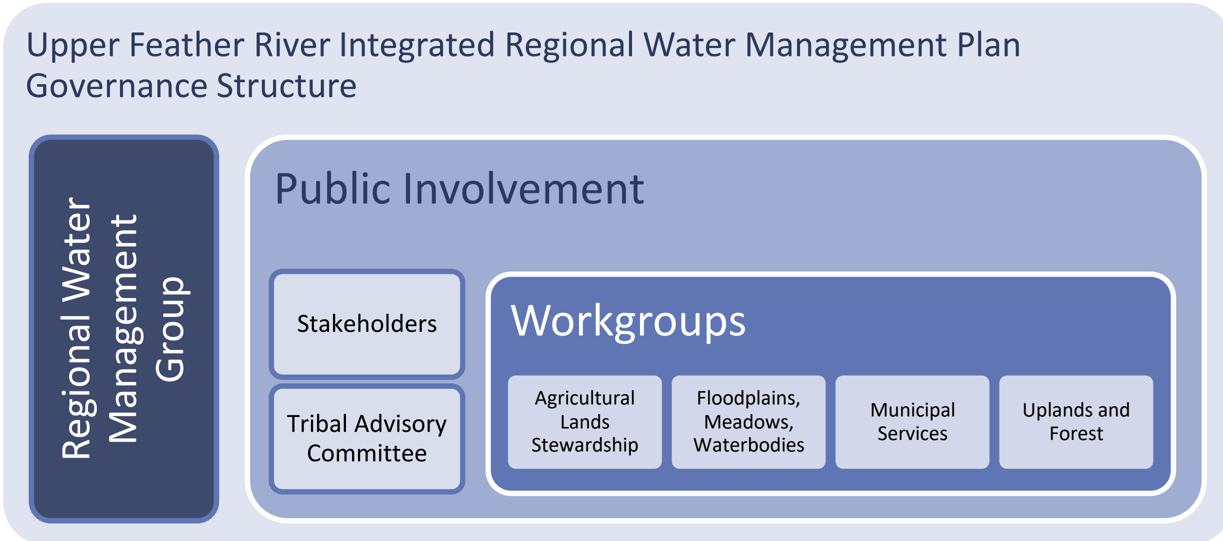
The MOU sets forth the governance structure for the IRWM planning, adoption and implementation processes. The basic structure of how the RWMG communicates with its members, its workgroups and the public is depicted in Figure 2-1. In general, the RWMG is the decision-making body for the IRWM Plan Update process, with support and recommendations provided by the workgroups, through public comments and presentations, and through focused outreach as needed.

2.3.1 Regional Water Management Group

Regional Water Management Group meeting

Per the Integrated Regional Water Management Act (California Water Code Section 10539), a RWMG is composed of three or more local agencies, two of which have statutory authority over water supply or water management, as well as those other persons who may be necessary for the development and implementation of an IRWMP. The Upper Feather River RWMG consists of twelve (12) member agencies (Table 2-1), all signatories of the MOU, with seven (7) of the agencies having statutory authority over water supply or management. The composition of the RWMG provides a broad representation of water resource, natural resource and land-use management interests for the Upper Feather River region.

Figure 2-1. Upper Feather River IRWM Plan Governance Structure



Members have agreed to work together to serve as the Upper Feather River Regional Water Management Group and to carry out the IRWM Program in the region throughout the planning and implementation phases.

Table 2-1. Regional Water Management Group (RWMG)

Agency/Entity/Workgroup	Representing	Statutory Authority over Water
County of Plumas	Local government, land use and disadvantaged communities	X
County of Sierra	Local government, land use, and disadvantaged communities	X
Feather River Resource Conservation District	Watershed issues and private landowner interests	
Sierra Valley Resource Conservation District	Watershed issues and private landowner interests	
Maidu Summit Consortium - Native American Representative	Federally and State recognized Tribes and Maidu Native American interests	
Plumas County Flood Control and Water Conservation District	Local government, flood and water conservation management, and State Water Project Contractor	X
Sierra Valley Groundwater Management District	Groundwater monitoring and management in Sierra Valley	X
Plumas County Community Development Commission	Disadvantaged communities, water and wastewater infrastructure, and affordable housing issues	
Representative from the Almanor Basin[a]	Water-related issues in the Almanor Basin	
Plumas National Forest – USDA Forest Service[b]	Plumas National Forest land, resource and water management	X

Agency/Entity/Workgroup	Representing	Statutory Authority over Water
Lassen National Forest, Almanor Ranger District[b]	Lassen National Forest land, resource, and water management	X
Tahoe National Forest, Sierraville Ranger District[b]	Tahoe National Forest land, resource, and water management	X

[a] The representative from the Almanor Basin is a public member appointed by the Plumas County Board of Supervisors.
[b] Federal entities serve in an advisory role only; they are not voting members.

The governing body of each of the RWMG member agencies or entities has appointed a member representative, a first alternate, and a second alternate. The first alternate member representative may sit and vote with the RWMG in the absence of the primary member, and the second alternate may sit and vote in the absence of the primary member and first alternate. Once appointed, the RWMG member representative or alternate serves a two-year term or until a successor is appointed. Both the primary member representative and the alternates may be reappointed to successive terms and they may be replaced at any time by the appointing authority for the agency.

The RWMG selects from its members a Chair and a Vice-Chair, each serving a one-year term. The Chair will preside over the meetings of the RWMG; the Vice-Chair assumes the duties of the Chair in the absence of the Chair.

2.3.2 Workgroups

Any stakeholder or member of the public may participate in the workgroups. The workgroups provide input on project selection and prioritization criteria, receive and present comments on draft IRWMP chapter reviews, and invite and schedule presentations by technical experts, scientists, and other interested parties for Workgroup and RWMG meetings. Five workgroups have been established to focus discussions and to make recommendations for long-term stakeholder interest within the UFR IRWM region.

The workgroups (below) are focused on the resource areas identified in the California Water Plan, and on issues in the UFR region:

Table 2-2. Workgroups* of the Upper Feather River IRWM Planning Process

Workgroup	Resource Areas of Focus
Agricultural Land Stewardship	Irrigated lands, water quality issues, agricultural water supply reliability, and agricultural water use efficiency
Floodplains, Meadows, and Waterbodies Management	Recharge area protection, flood risk management, pollution prevention, ecosystem restoration, and conjunctive management and groundwater
Municipal Services	Recycled municipal water, urban water use efficiency, groundwater and surface water pollution prevention, water system reoperation, drinking water treatment and distribution, and perhaps groundwater and aquifer remediation, urban runoff management, and matching water quality to use
Tribal Advisory Committee	Cultural and environmental issues that cross all workgroup categories; topics such as Traditional Ecological Knowledge (TEK) toward restoration and stewardship
Uplands and Forest Management	Pollution prevention (wildfires, roads), watershed management (forest-water interactions), forest ecosystem restoration, upland

Workgroup	Resource Areas of Focus
	recharge area protection, flood risk reduction (through wildfire risk reduction), precipitation enhancement (better groundwater infiltration and less evapotranspiration through forest stand density reduction), and other general issues

* Four workgroups were originally identified in the MOU. The RWMG added a fifth working group, identified as the Tribal Advisory Committee, at its May 29, 2015 meeting.

To encourage ownership and participation in the process, each workgroup's participants select a chair and alternate amongst themselves to assist the Workgroup Coordinator with meetings and to act as liaison to the RWMG. Workgroups review proposals for plans, projects, and any other actions and provide input to each of the Workgroup Chairs. A Workgroup Coordinator, provided by the IRWM Plan Update Consultant Team, coordinates and facilitates meetings, supports the workgroups with baseline data and information, and performs continuous outreach efforts throughout the Plan process. The Workgroup Coordinator and Chairs collaborate on workgroup meetings, coordinate workgroup tasks, and present proposals and recommendations for consideration to the RWMG members.

2.3.3 Decision-making

The Plan Update process includes decision-making criteria at two levels. A majority of the RWMG membership constitutes a quorum for the transaction of business and decisions. The affirmative votes of at least a majority of the RWMG members shall be required for any action by the RWMG.

A process for decision-making at the workgroup level is also established in the MOU. Decision-making by workgroup members is structured to seek consensus (approval) through super majority agreement. In this context, consensus does not necessarily mean that all workgroup members support an action, but rather no workgroup member should be opposed to the action that is forwarded to the RWMG for consideration.

The ultimate decision-making authority lies with the RWMG. In general, the nine voting members of the RWMG participate in the decision-making process without hierarchical differentiation, and all major IRWM planning decisions and milestones are decided by vote during the meetings. For any action or major decision, a majority vote of the RWMG members (present or via conference call) is required. The three National Forests represented on the RWMG (Plumas, Tahoe, and Lassen) serve in an advisory role and are not voting members.

2.3.4 Plan Adoption

In accordance with Proposition 84 and 1 Guidelines, the governing bodies of each of the 12 participating agencies of the RWMG are responsible for the development of the IRWM Plan, have responsibility for implementation of the IRWM Plan, and must formally adopt the IRWM Plan. Signatories of the MOU are expected to adopt the IRWM Plan after it is approved by the RWMG. Proof of adoption is a resolution (or other written documentation) with signatory blocks for each governing body adopting the Plan. See Appendix 1-3 for Adopting Resolution of the RWMG.

2.4 Stakeholder Participation in the Plan Process

Stakeholder participation

The governance structure and the processes of the RWMG are intended to elicit public participation and involvement in developing the IRWM Plan Update, project selection criteria, and other RWMG activities. To this end, all RWMG meetings are open to the public, in person or by video conference, and each meeting includes scheduled time for public input. Information regarding the Plan Update process and RWMG meetings is available on the Plan website (http://featherriver.org). Interested parties may sign up through the website or via e-mail at UFR.contact@gmail.com to receive meeting notices and materials, attend meetings via teleconferencing, participate in discussions, and receive invitations to UFR project development activities.

2.5 Stakeholder and Public Involvement

Stakeholders are integral to identifying issues, developing resource management strategies (RMS), and defining objectives. Stakeholders in the UFR region include water management agencies, conservation groups, counties, federal entities, Tribal communities, regional watershed groups and councils, agricultural interests, disadvantaged communities (DAC), and the public. Stakeholders were initially identified by working with recent and existing regional planning efforts and organizations (i.e., Plumas County General Plan Update, Collaborative Forest Landscape Restoration Act, Plumas County Special Districts Association, Cattleman's Association, etc.). A Stakeholder Involvement Plan (SIP) adopted by the RWMG in November 2014 sets forth outreach efforts to encourage a diverse group of informed local stakeholders throughout the UFR region (Appendix 2-2) to participate. Additionally, a Tribal Engagement Plan (TEP) was developed to describe outreach and involvement means for engaging Tribal communities in the Region (Appendix 2-3). Stakeholders may take part in the IRWM Plan update process through the workgroups and Tribal Advisory Committee as well as by attending RWMG meetings and workshops. All stakeholders are added to contact lists; they then receive Plan Update communications and notices.

Stakeholder outreach began long before the Plan Update process started in September 2014 through informal discussions with various agencies and entities throughout the region. To initiate the Plan Update process, in accordance with §6066 of the Government Code, the RWMG published a notice of intent to prepare the Plan on October 22 and 29, 2014. The RWMG will publish a notice of intention to adopt the Plan in a public meeting of the RWMG governing board to be held on November 18, 2016 (CWC §10543).

2.5.1 Outreach to Disadvantaged Communities

During the UFR IRWM Plan update process, DAC service providers were surveyed regarding their water issues and needs (Chapter 3 *Region Description,* Table 3-3). A Community Vulnerability Assessment (Appendix 10-1) was prepared in coordination with the Plumas and Sierra County Departments of Environmental Health, County staff, and IRWM Plan consultants who worked closely with disadvantaged community members in order to identify ground water well vulnerability factors and concerns. The study information will be used as a template to better identify drinking water pollution risks for the approximately 40 percent of groundwater-dependent households in the DAC-dominated region that rely on individual and/or community wells and septic systems for their water and wastewater needs. The study assesses nitrate pollution risks to municipal and domestic drinking water wells in high groundwater table areas with septic systems and agricultural livestock production.

2.5.2 Outreach to Native American Tribes

Tribal outreach is led by the California Indian Environmental Alliance (CIEA) and includes a local Tribal member as an outreach coordinator. The local Tribal member is a designated representative for the Maidu Summit Consortium, a signatory of the MOU, and is a member of the RWMG. The outreach efforts have resulted in formation of a Tribal Advisory Committee (TAC). The TAC meets approximately every other month to review and discuss IRWM process tasks, to review and discuss project proposal development and implementation, and to coordinate feedback and input on the process and Plan. The TAC's input is relayed to the RWMG through the designated Tribal member of the RWMG and through standing public comment, update opportunities, and presentations during RWMG meetings. An important cultural and environmental value that has been incorporated into the Upper Feather River IRWM through the TAC is Traditional Ecological Knowledge (TEK), which will be integrated into implementation project development.

2.6 Communication Plan

2.6.1 Methods, Technology and Information Access

The overall communications strategy for the UFR IRWM Plan Update is designed to be accessible, inclusive and transparent. RWMG members and stakeholders receive timely and consistent updates and information regarding Upper Feather River IRWM Program activities and goals. Extensive communication efforts ensure that stakeholders, project proponents, and the public remain well informed of the latest UFR IRWM activities and accomplishments through:

- Traditional media
- Press releases, distributed to local newspapers
- Press releases, posted on the UFR IRWM website (www.featherriver.org)
- Notice of public meetings, meeting summaries and videos, reports, background information, a document library, GIS mapping tool, and information on the Plan process and content, posted on the UFR IRWM website
- Continuously updated contact lists, including e-mail, mail, or phone numbers
- Personal communications
- Printed materials, available at meetings and workshops, such as IRWM Plan pamphlets and educational handouts
- Presentations to organizations as requested, including four public information meetings held in different locations in the region to promote accessibility

The Stakeholder Involvement Plan (Appendix 2-2) contains a detailed communication strategy for the UFR IRWM Plan update process.

The MOU requires that public education opportunities be solicited on behalf of the Plan Update process, such as presentations to community organizations and at community functions, media interviews and the distribution of educational materials to the MOU signatories, or at conferences and workshops. All meetings of the RWMG, except those closed sessions authorized by the "Brown Act" (California Government Code Section 54950, et seq.), are open to the public and noticing of such meetings shall be in accordance with the Brown Act and include public comment opportunities.

2.7 Coordination

2.7.1 Adjacent IRWM Regions

Neighboring IRWM planning regions include Lahontan, Tahoe-Sierra, Cosumnes-American-Bear-Yuba (CABY), Upper Pit, Yuba County, and Northern Sacramento Valley IRWM groups. The RWMG and consultant team members communicate with neighboring IRWMs to share lessons learned, process feedback, and share resources where appropriate. Additionally, members of the UFR IRWM Plan update team regularly attend and are involved in the Sierra Water Workgroup, a group that works to coordinate local and regional water planning efforts in the Sierra.

2.7.2 State and Federal Agencies

The three National Forests represented on the RWMG--Lassen, Tahoe and Plumas—manage approximately 70 percent of the region. California state agencies--the Department of Water Resources, the Central Valley Regional Water Quality Control Board, the Department of Conservation, and the Department of Fish and Wildlife—also have significant management interests in the region; the RWMG has encouraged them to designate liaisons to attend and participate in meetings. Outreach also includes communicating with energy and water supply utilities, such as Pacific Gas and Electric (PG&E) and local municipal services providers. For example, PG&E presented information and data developed for the current efforts to relicense its Feather River hydroelectric development, which runs from Lake Almanor nearly to Lake Oroville (known as the "Staircase of Power").

CHAPTER 3.0 REGION DESCRIPTION

3.1 Introduction

The Upper Feather River watershed encompasses 2.3 million acres in the northern Sierra Nevada, where that range intersects the Cascade Range to the north and the Diamond Mountains of the Great Basin and Range Province to the east. The watershed drains generally southwest to Lake Oroville, the largest reservoir of the California State Water Project (SWP). Water from Lake Oroville enters a comprehensive system of natural and constructed conveyances to provide irrigation and domestic water as well as to supply natural aquatic ecosystems in the Lower Feather River, Sacramento River, and the Sacramento-San Joaquin Delta. Lake Oroville is the principal storage facility of the SWP, which delivers water to over two-thirds of California's population and provides an average of 34.3 million acre-feet (AF)/year of agricultural water to the Central Valley.

Lands to the east of the Upper Feather River watershed drain to Eagle and Honey Lakes that are closed drainage basins in the Basin and Range Province, while lands to the north, west, and south drain to the Sacramento River via the Pit River, Yuba River, Battle Creek, Thomas Creek, Big Chico Creek, and Butte Creek. Mount Lassen, the southernmost volcano in the Cascade Range, defines the northern boundary of the region. Sierra Valley, the largest valley in the Sierra Nevada, defines the southern boundary. At the intersection of the Great Basin, the Sierra Nevada Mountains, and the Cascade Range, the Region supports a diversity of habitats including an assemblage of meadows and alluvial valleys interconnected by river gorges and rimmed by granite and volcanic mountains. The wild and scenic Middle Fork of the Feather River plunges through granite walls and boulders for nearly 80 miles. The North Fork of the Feather River provides water for some of the most important hydroelectric and water supply developments in California, and during winter storm events is ringed by over 50 waterfalls plunging to the river and roadway from the cliffs and tributary streams within the Feather River canyon.

3.2 Explanation of Regional IRWM Boundary

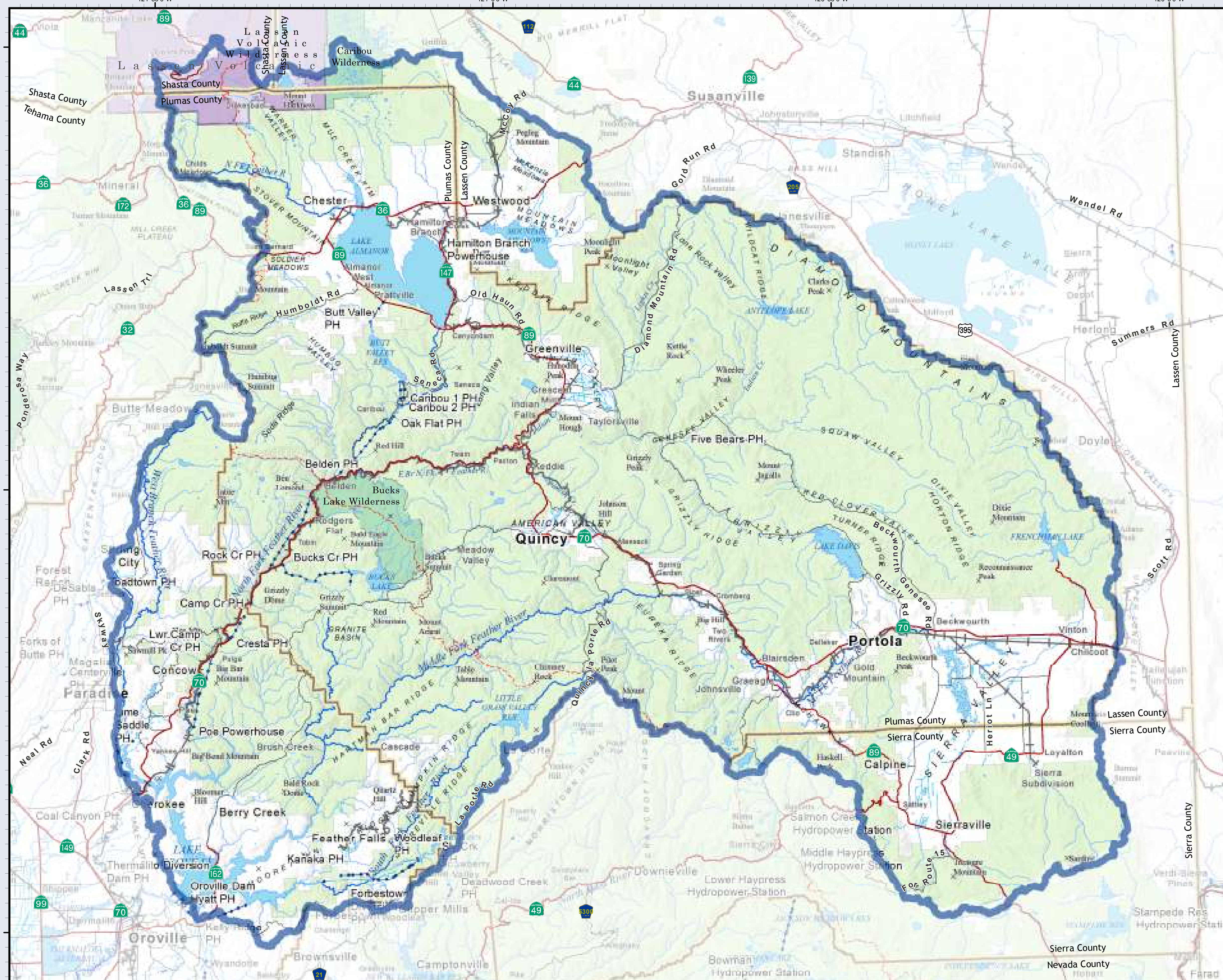
3.2.1 Jurisdictional Boundaries

Land ownership in the Integrated Regional Water Management (IRWM) Plan Area is approximately 64 percent Federal, 1 percent State, and 35 percent private. Federal lands are managed primarily by the U.S. Forest Service (USFS) except for less than 1 percent of the watershed that is within Lassen Volcanic National Park and some Bureau of Land Management lands in the Sierra Valley watershed. Approximately 50 percent of the National Forest System lands in the watershed are administered by the Plumas National Forest, with the remainder administered by the Tahoe and Lassen National Forests. The private land in the watershed is primarily used for commercial timber and agriculture, and is interspersed with historic community settlements and recreational developments. The Region is also entirely within the boundary of the Central Valley Regional Water Quality Control Board (Central Valley RWQCB).

The entire IRWM Plan Area is within the portion of the Feather River watershed that drains to Lake Oroville. The boundary of the watershed largely corresponds to the boundary of Plumas County, but also includes portions of six neighboring counties (Table 3-1, Figure 3-1).

Upper Feather River Integrated Regional Water Management Planning Area

Figure 3-1 Upper Feather River IRWM Region



Upper Feather River IRWM Planning Area
Major Stream or River
Streams
Canal or Ditch
Pipeline, Aqueduct, Penstock
National Forest
National Park
County
USFS Wilderness Area
NPS Wilderness Area

0 2.5 5 10 15
Miles

Cartography by Deer Creek GIS
www.deercreekgis.com

Table 3-1. Counties within the Upper Feather River Watershed

County	Total Size (ac.)1	Area in Watershed (ac.)2	Percentage in Watershed	Percent of Watershed
Butte	1,073,340	345,850	32.2	14.9
Lassen	3,021,050	119,394	3.9	5.2
Plumas	1,672,640	1,653,456	98.9	71.7
Shasta	2,462,340	13,574	0.6	0.6
Sierra	615,680	172,367	27.9	7.5
Tehama	1,895,870	136	<0.1	<0.1
Yuba	411,970	1,780	0.4	<0.1
Total	--	2,306,557	--	100
[1]**Source: http://www.dof.ca.gov/html/FS_DATA/STAT-ABS/documents/A1.pdf**				
[2]**Source: Plumas County 2009**				

There are two incorporated cities in the IRWM Plan Area: the City of Portola in Plumas County and the City of Loyalton in Sierra County. There are approximately 37 unincorporated communities, including but not limited to Quincy, East Quincy, Delleker, Chester, Greenville, Taylorsville, Westwood, Sierraville, and Graeagle.

A total of 27 water, wastewater, conservation, irrigation, and flood control districts are located entirely within the IRWM Plan Area (Table 3-2, Figure 3-2, and Figure 3-3). With the possible exception of irrigation districts, these individual district service areas do not significantly affect the land management of the Upper IRWM Planning Area.

Upper Feather River Integrated Regional Water Management Planning Area

Figure 3-2 Jurisdictional Boundaries and Adjacent IRWM Areas

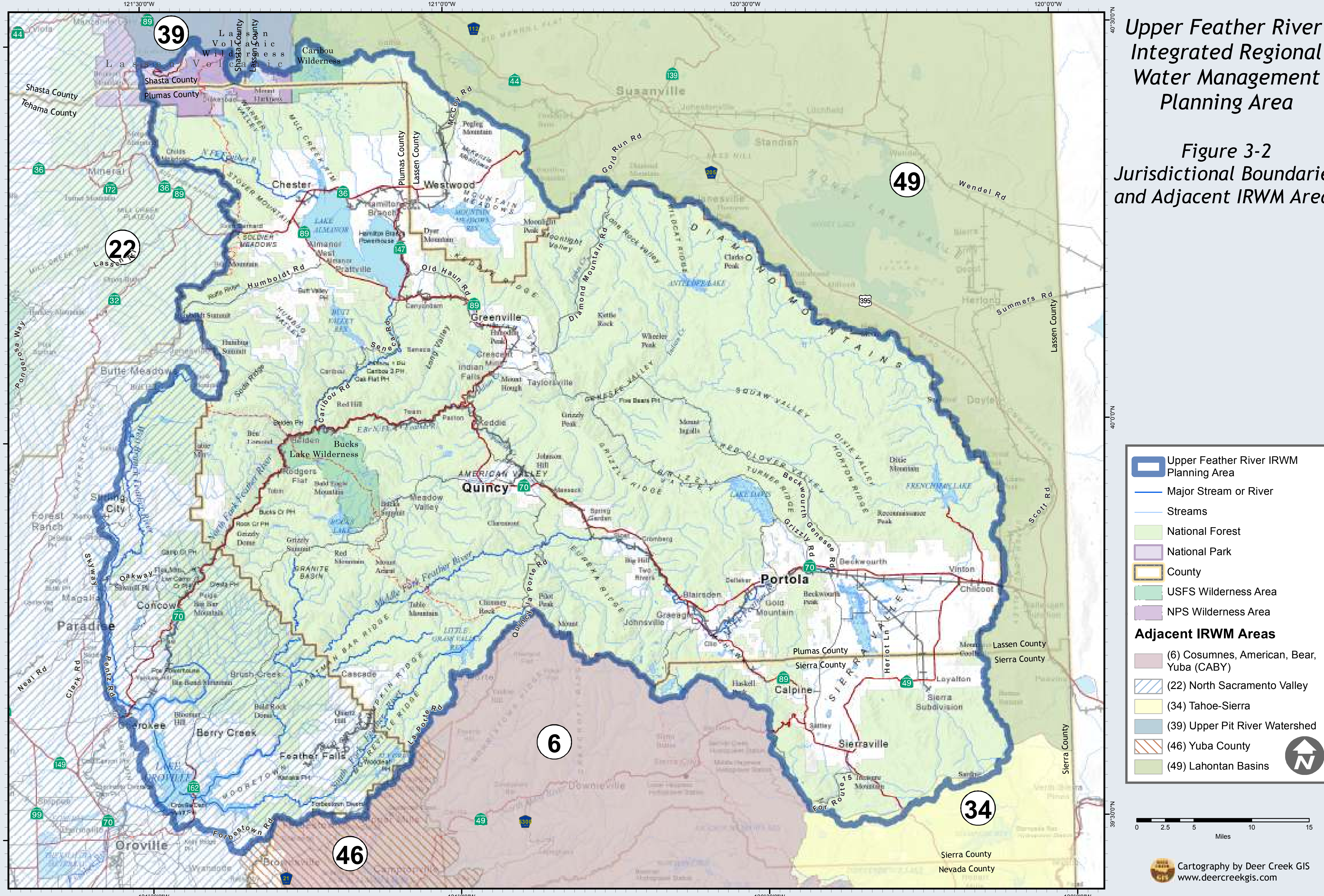


Table 3-2. Agency Services within the Upper Feather River IRWM Plan Area

Agency/District	Water	Wastewater	Irrigation	Conservation	Flood Control	Groundwater
Plumas County Flood Control and Water Conservation District	X				X	X
Sierra Valley Groundwater Management District						X
Sierra Valley Mutual Water District[b]			X			
Last Chance Creek Water District			X			
Feather River Resource Conservation District				X		
Sierra Valley Resource Conservation District				X		
City of Loyalton	X	X				
City of Portola	X	X			X	
Chester Public Utility District	X	X				
East Quincy Community Services District	X	X				
Gold Mountain Community Services District	X	X				
Greenhorn Creek Community Services District	X	X				
Grizzly Lake Resort Community Services District	X	X				
Grizzly Ranch Community Services District	X	X				
Indian Valley Community Services District	X	X				
Plumas Eureka Community Service District	X	X				
Quincy Community Services District	X	X				
Walker Ranch Community Services District	X	X				
Westwood Community Services District	X	X				
Beckwourth County Service Area		X				
West Almanor Community Services District		X				
Clio Public Utilities District	X					
Clear Creek Community Services District	X					
Hamilton Branch Community Services District	X					
Johnsville Public Utilities District	X					
Graeagle Community Services District	X					
Feather River Canyon Community Service District	X					
Department of Water Resources: Indian Valley and Sierra Valley Water Master Service Areas			X			

[a] **Source: Plumas, Sierra, and Lassen Local Agency Formation Commissions**
[b] **The Sierra Valley Mutual Water District is not a special district; it is a private irrigation district.**

It is important to note that approximately 40 percent (Plumas Co. 2009) of the population in the Upper Feather River Region relies on individual wells and septic systems and, therefore, are not served by municipal water and wastewater districts. Additionally, dependence on groundwater by municipal services providers and domestic households is a significant jurisdictional water management characteristic and a challenge for the Region.

3.2.2 Physical Boundaries

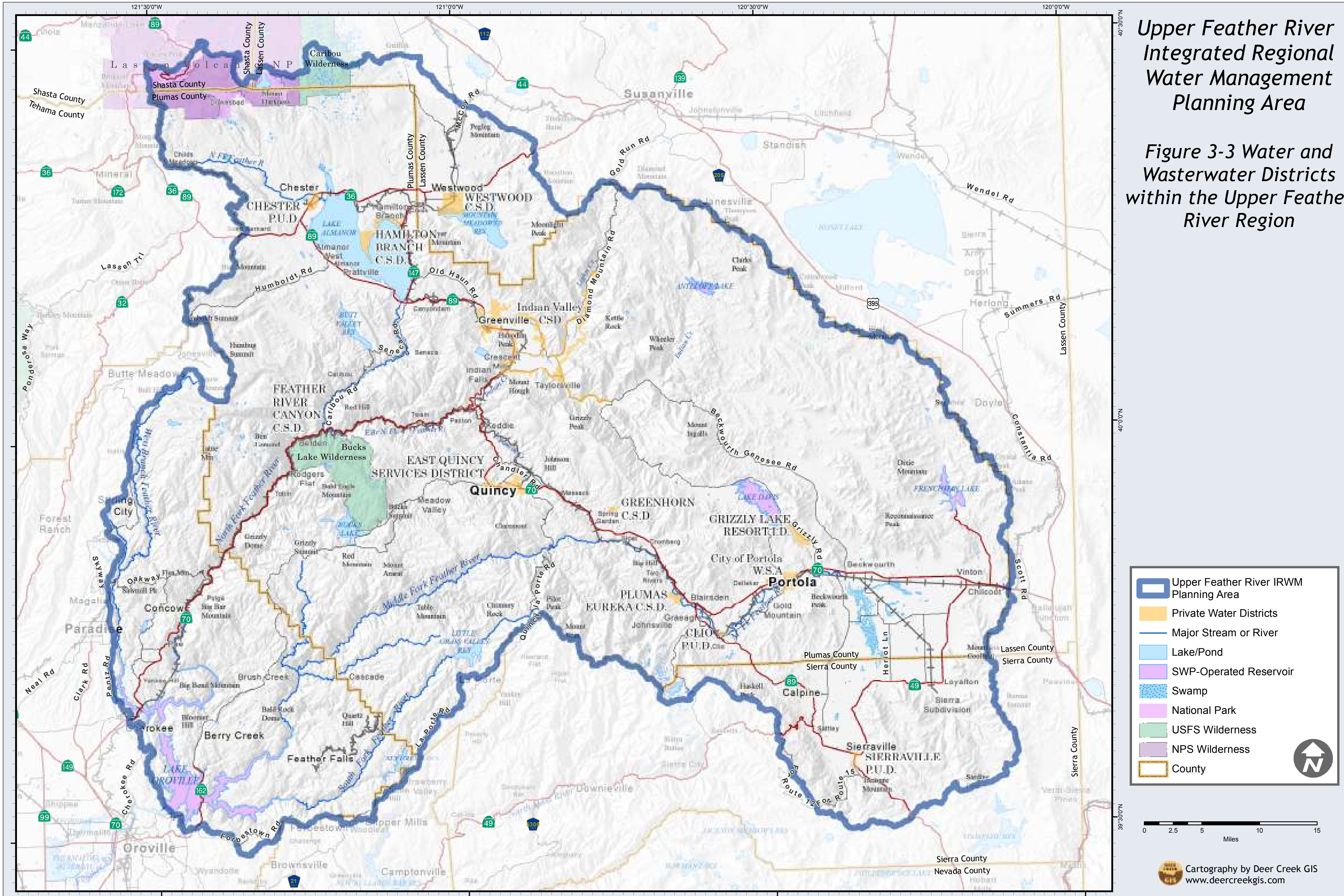
The physical boundaries of the IRWM Plan Area are the Feather River watershed's mountain escarpments upstream of Oroville Dam. Lake Oroville, the downstream terminus of the Plan Area, provides a fixed point, where the effects of management actions in the upper watershed drain to infrastructure of statewide water importance. This reflects land and water management on a regional scale as it is monitored and measured as inflows to Lake Oroville, the SWP, and PG&E's "Stairway of Power." The Feather River is unique among Sierra Nevada streams in that it breaches the Sierra Crest of the Diamond Mountains and drains both the west and east slopes of the Sierra Range to the Sacramento River. The Feather River is one of the largest watersheds in the Sierra Nevada.

The northern boundary of the IRWM Plan Area runs southeast from Mount Lassen, through volcanic highlands separating the Feather River and Pit River watersheds, until intersecting the crest of the Diamond Mountains east of Lake Almanor. The boundary follows the Diamond Mountains south, crosses the historic Beckwourth Pass (the lowest pass in the Northern Sierra for the first European settlers to the region), and runs westward along the Sierra Crest which separates the Feather River watershed from the Truckee River watershed. The Sierra Crest also forms the southwest boundary of the IRWM Plan Area, where the Yuba River drains the western slope of the range and the Feather River drains the eastern slope. The Region includes the western slope of the Sierra Nevada where the Middle and North Forks of the Feather River carve through the lava flows of the foothills, and follow the western slopes of the Sierra Nevada and the southern end of the Cascade Range to the base of Mount Lassen.

Because of the small population and limited municipal infrastructure in the IRWM Plan Area, water management issues in the Plan Area are predominantly defined by landscape-scale hydrologic processes and focus on the intersection of water and land management activities, such as watershed management, forest management, agricultural irrigation practices, and integrated surface and groundwater management. Despite the small population of the region, land and water management activities in the Plan area have significant implications for both upstream and downstream beneficiaries of flood control, water supply, and hydroelectric power. The physical boundary of the IRWM Plan Area reflects the watershed- and landscape-scale issues that define the region, and provides a workable geographic scale for addressing those issues in an effective, efficient, and integrative manner for both local, regional, and downstream needs and values.

Upper Feather River Integrated Regional Water Management Planning Area

Figure 3-3 Water and Wastewater Districts within the Upper Feather River Region



3.2.3 *Neighboring/Overlapping IRWM Region Boundaries*

The Upper Feather River IRWM Plan Area borders or overlaps with six adjacent IRWM plan areas (Figure 3-2).

3.2.3.1 Upper Pit River Watershed IRWM Region

The Upper Pit River Watershed IRWM Region lies to the north of the Upper Feather River IRWM Plan Area, and there is no overlap in plan area boundaries. The Pit River is the principal drainage of northeastern California and drains large portions of Modoc, Lassen, Shasta, and Siskiyou counties. The two plan areas share a short boundary east of Mount Lassen, mostly within Lassen Volcanic National Park.

3.2.3.2 Lahontan Basins IRWM Region

The Lahontan Basins IRWM Region encompasses portions of the Susan River, Madeline Plains, and Smoke Creek watersheds in California, and lies within Lassen County and the extreme northeast corner of Sierra County, north and east of the Upper Feather River IRWM Plan Area. The divide between these watersheds and the Upper Feather River watershed also marks the boundary between the Central Valley RWQCB and the Lahontan RWQCB, and between IRWM funding areas. The Upper Feather River IRWM Plan Area does not overlap geographically with the Lahontan Basins IRWM Plan Area; however, there are multiple jurisdictional overlapping IRWM areas in Sierra County.

3.2.3.3 Cosumnes, American, Bear, Yuba (CABY) IRWM Region

The CABY IRWM Region encompasses the watersheds on the western slope of the Sierra Nevada between the Feather and Mokelumne Rivers, and borders the Upper Feather River IRWM Plan Area to the southwest along the divide between the Feather River and Yuba River watersheds. There is no overlap between the Upper Feather River and CABY IRWM Plan Areas.

3.2.3.4 Yuba County IRWM Region

Yuba County adopted an IRWM Plan in 2008, to manage the fisheries and riparian habitats on the Yuba River, which enters the Lower Feather River at Marysville. The plan area includes all of Yuba County, 1,780 acres of which is in the Upper Feather River IRWM Plan Area. This area of overlap lies in the extreme northeast of Yuba County, where the Yuba-Butte county line crosses the hydrologic divide between the Upper Yuba River and the Middle Fork Feather River and is characterized by National Forest ownerships.

3.2.3.5 Tahoe-Sierra IRWM Region

The Tahoe-Sierra IRWM Region encompasses portions of the Tahoe Basin and the Truckee and Carson River systems in California, and borders the Upper Feather River IRWM Plan Area on the south. The divide between these watersheds and the Upper Feather River watershed also marks the boundary between the Central Valley RWQCB and the Lahontan RWQCB, and between IRWM funding areas. The Upper Feather River IRWM Plan Area does not overlap geographically with the Tahoe-Sierra IRWM Plan Area; however, there is jurisdictional overlap on the part of Sierra County and Tahoe National Forest. There is a hydrologic connection between the watersheds through a water diversion from the Little Truckee River to Sierra Valley.

3.2.3.6 Northern Sacramento Valley IRWM Region

The Northern Sacramento Valley IRWM Region includes all of Sutter, Colusa, Glenn, Butte, and Tehama counties, and the southwestern half of Shasta County. The North Sacramento Valley IRWM Plan Area overlaps the Upper Feather River IRWM Plan Area in the eastern one-third of Butte County. Both plans consider the overlap area to be an important and appropriate part of their respective plan areas for the following reasons:

1. The Upper Feather River IRWM Plan Area is based on a watershed boundary that encompasses the entire Feather River watershed upstream of Oroville Dam;
2. It is important to include Lake Oroville and the western portion of the Upper Feather River watershed in the IRWM Plan Area because the impoundment at Lake Oroville integrates effects of management activities across the entire upper watershed, and provides a logical physical and institutional point of division between the Upper and Lower Feather River regions;
3. Plumas National Forest, which is a key partner in the Upper Feather River IRWM Plan and manages nearly half of the land in the Upper Feather River watershed, extends into Butte County in the vicinity of Lake Oroville, and;
4. The Northern Sacramento Valley IRWM Plan Area includes all of Butte County for practical administrative reasons, and the Butte-Plumas county line does not follow any natural or hydrologic divide and so represents an arbitrary division of the Feather River watershed upstream of the confluence of the major forks of the Feather River at Oroville Dam.

Primary issues within the Northern Sacramento Valley IRWM Plan Area relate to groundwater management and conjunctive use focused on the Sacramento Valley floor, while primary issues in the Upper Feather River IRWM Plan Area relate to management of watershed values for upstream and downstream recipients, and ecological integrity in headwaters areas. The Northern Sacramento Valley and the Upper Feather River RWMGs are working to establish a Memorandum of Understanding regarding divisions of responsibility and coordination of land and water management activities in the Butte County overlap area. Butte and Plumas Counties have communicated and coordinated on water management issues of mutual interest for decades such as the FERC hydroelectric licenses in the NFFR, as "Area of Origin" State Water Project Contractors, and over public safety issues in the Feather River Canyon such as railroad and roadway pollution spills and other accidents, floods and wildfires.

3.2.3.7 Opportunities for Integration of Water Management

The RWMG and consultant team members communicate with neighboring IRWMs to share lessons learned, process feedback, and share resources where appropriate. Additionally, members of the UFR IRWM Plan update team regularly attend and are involved in the Sierra Water Workgroup, a group that works to coordinate local and regional water planning efforts in the Sierra. See Chapter 7 *Land Use and Water Planning* for further discussion.

3.3 Social and Cultural Characteristics of the Regional Community

3.3.1 Population and Demographics

The Upper Feather River IRWM Plan Area is predominantly rural and mountainous, with a population density of approximately seven people per square mile not including the more densely populated parts of Butte County such as Oroville East and Concow. Population centers in the Plan Area include the communities of Chester, Westwood, Quincy, East Quincy, Delleker, Graeagle, Sierraville, Greenville, Taylorsville, Loyalton, Beckwourth, Chilcoot-Vinton, and Portola. The population of the Plan Area is approximately 33,200, with approximately 20,000 of those living in Plumas County, less than 2,000 in Lassen County, less than 2,000 in Sierra County, and none in Shasta, Tehama, and Yuba counties. The remainder, approximately 9,200 people, live in eastern Butte County. The Butte County communities are oriented toward Sacramento Valley cities such as Chico, and are economically and culturally distinct from the majority of the Plan Area with some significant exceptions discussed below. The population trend in Plumas and Sierra counties has been negative since 2005 and the California Department of Finance predicts continued population declines in those counties through 2030.

According to U.S. Census Bureau data, the majority of the inhabitants of the Plan Area are White persons not of Hispanic/Latino origin (91.1 percent). The next largest group is Hispanic/Latino (8.3 percent), followed by Native American and Alaska Native (3.2 percent), African American (1 percent), Asian (1 percent), and Native Hawaiian and other Pacific Islanders (0.1 percent). The population of the Plan Area is older than the statewide average; all age groups under 20 years have declined since 2000, while all age groups between 45 and 75 years have increased. The timber industry in the region has been in decline since the late 1980s, which has led to a departure of working-age people with children. At the same time, the number of retirees and part-time residents has increased markedly. This trend is expected to continue for the next several decades. The "capacity" issue that is an IRWM Planning priority in this Plan update is directly related to the changing demographics and the loss of working-age residents and families to economic and employment opportunities in other regions of California.

3.3.2 Disadvantaged Communities

The Department of Water Resources defines a Disadvantaged Community (DAC) as one with an annual median household income (MHI) that is less than 80 percent of the statewide average MHI. Analysis of DACs in the Plan Area is based on data from the U.S. Census American Community Survey 5-Year Data: 2009-2013. U.S. Census geographies used to identify DACs include Census Designated Places, Tracts, and Block Groups. During the 5-year period used for this analysis, the statewide average MHI was \$61,094; therefore, the threshold for defining a DAC was \$61,094*0.8 = \$48,875.


Greenville, California (Plumas County)

Water and/or wastewater services in most of the Plan Area are provided by 22 local districts (Table 3-2), in addition to individual private wells and septic systems. Most of these special districts serve rural communities where the tax base is declining due to population and job loss, and is already limited by a large proportion of the land being in federal ownership. The aging residents of these areas are increasingly challenged to maintain basic services as local and federal budgets shrink and the traditional pool of volunteers to serve on local district boards is lost. Nearly all of the communities in the portion of the Plan Area in Plumas, Lassen, and Sierra counties qualified as DACs for the period 2009-2013 (Table 3-3, Figure 3-4). Plumas and Sierra counties, which represent 79.2 percent of the region's population, have an overall MHI that falls below the threshold for DACs at \$45,794 and \$39,009, respectively.

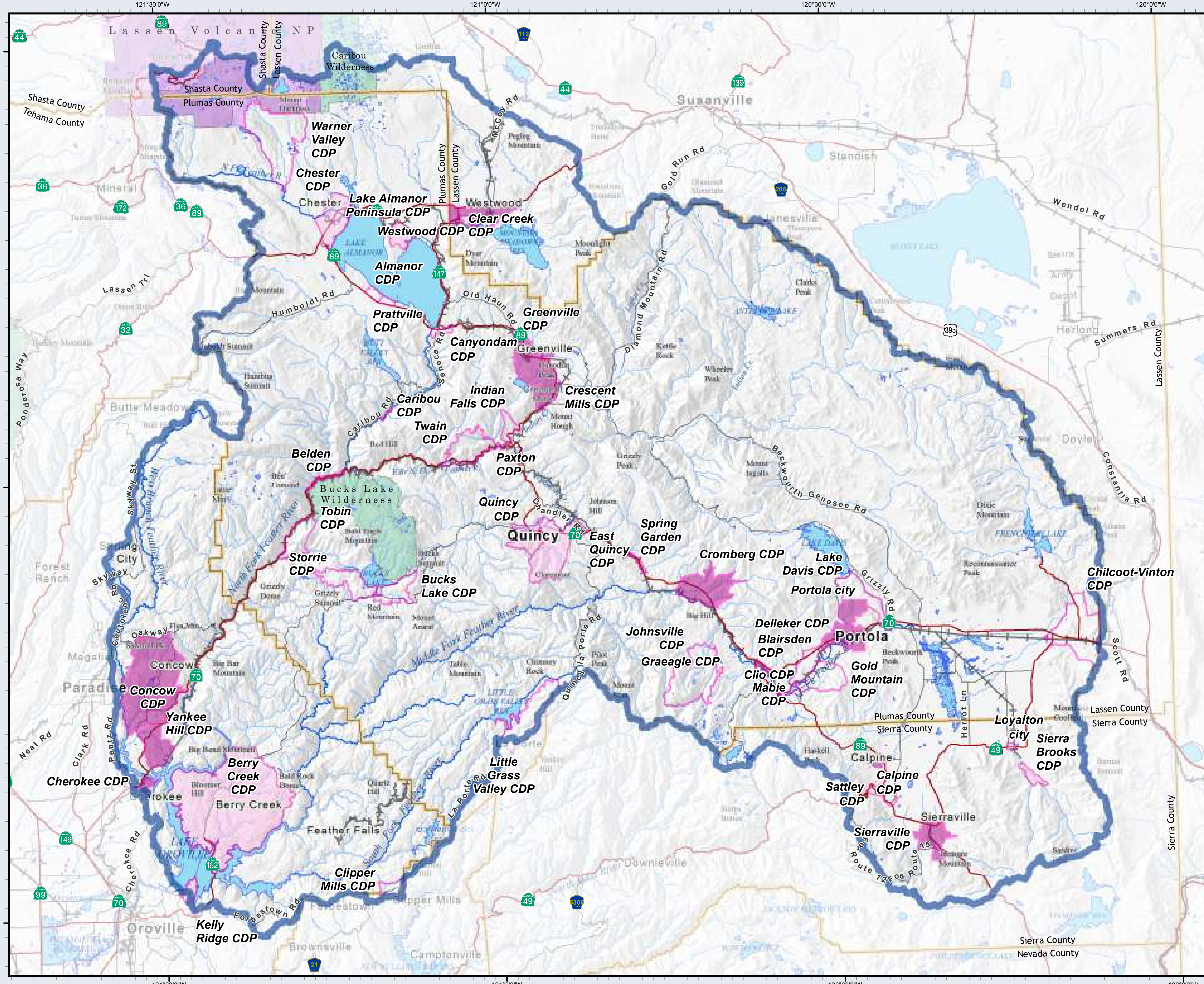
Table 3-3 Disadvantaged Communities in the Upper Feather River IRWM Plan Area

Community	Population	Households	Annual MHI[b]	Percent of Statewide MHI[c]	County
Westwood CDP[a]	1,582	748	$28,158	46.1	Lassen
Clear Creek CDP	192	93	$33,542	54.9	Lassen
Warner Valley CDP	5	5	NA	--	Plumas
Chester CDP	1,908	891	$40,331	66.0	Plumas
Lake Almanor Peninsula CDP	482	220	$46,667	76.4	Plumas
Almanor CDP	10	10	NA	--	Plumas
Canyondam CDP	0	0	NA	--	Plumas
Greenville CDP	922	488	$30,129	49.3	Plumas
Crescent Mills CDP	233	70	$31,413	51.4	Plumas
Caribou	0	0	NA	--	Plumas
Indian Falls CDP	35	20	NA	--	Plumas
Twain CDP	21	11	NA	--	Plumas
Belden CDP	52	37	NA	--	Plumas
Tobin	11	11	NA	--	Plumas
Bucks Lake CDP	0	0	NA	--	Plumas
Quincy CDP	1,442	732	$44,417	72.7	Plumas
East Quincy CDP	2,560	1,158	$45,417	74.3	Plumas
Spring Garden CDP	0	0	NA	--	Plumas
Cromberg CDP	135	86	$31,111	50.9	Plumas
La Porte CDP	13	13	NA	--	Plumas
Little Grass Valley	19	9	NA	--	Plumas
Johnsville CDP	8	5	NA	--	Plumas
Graeagle CDP	548	311	$42,688	69.9	Plumas
Blairsden CDP	26	16	NA	--	Plumas
Clio CDP	35	35	$25,250	41.3	Plumas
Whitehawk CDP	31	23	NA	--	Plumas
Gold Mountain CDP	25	14	NA	--	Plumas
Mabie CDP	0	0	NA	--	Plumas
Delleker CDP	824	310	$33,750	55.2	Plumas
Portola City	2,880	1,163	$34,942	57.2	Plumas
Lake Davis	38	25	NA	--	Plumas
Chilcoot-Vinton CDP	233	105	$47,607	77.9	Plumas
Calpine CDP	180	87	$17,472	28.6	Sierra
Sattley CDP	59	35	NA	--	Sierra
Sierraville CDP	105	29	NA	--	Sierra
Loyalton City	840	306	$34,063	55.8	Sierra
Sierra Brooks CDP	312	142	$32,685	53.5	Sierra

[a]CDP=Census Designated Place
[b]NA=no data available
[c]DAC threshold is 80 percent
Source: Data included in the table above was taken from the DWR's DAC mapping tool, which utilizes U.S. Census American Community Survey (ACS) 5-Year Data: 2009 - 2013 (with an MHI of $61,094 and hence a calculated DAC threshold of $48,875). Available at: http://www.water.ca.gov/irwm/grants/resources_dac.cfm

Upper Feather River Integrated Regional Water Management Planning Area

Figure 3-4 Disadvantaged Communities within the Upper Feather River Region



Disadvantaged Communities

- Data Not Available
- Severely Disadvantaged Community
- Disadvantaged Community

- Upper Feather River IRWM Planning Area
- Major Stream or River
- Streams
- LakePond; Playa; Reservoir
- SwampMarsh
- National Park
- USFS Wilderness
- NPS Wilderness
- County

0 2.5 5 10 15
Miles

Cartography by Deer Creek GIS
www.deercreekgis.com

The data included in the table above is taken from the DWR DAC mapping tool, which utilizes the U.S. Census American Community Survey (ACS) 5-year data: 2009-2013. The ACS dataset did not include MHI information for the smaller CDPs, which resulted in "NA" for that category. The DWR methodology identifies these CDPs as being DACs.

A Socio-Economic Assessment of the Upper Feather River Watershed was prepared by the Sierra Institute for Environment and Community to further refine the DWR mapping of DACs. The data replied upon by DWR for identifying DACs contains data gaps, particularly for rural regions. The DACs listed in Table 3-3 were identified through a combination of the two methods. The Assessment is included in Appendix 3-1.

3.3.3 Native American Tribes

The Maidu Tribes traditionally inhabited the northern Sierra Nevada and southern Cascades between Lassen Peak and the American River. Three groups of closely related peoples are referred to as the Maidu: the Mountain Maidu of Plumas and Lassen counties, the Konkow of Butte and Yuba counties, and the Nisenan of Yuba, Nevada, Placer, Sacramento, and El Dorado counties. Maidu tribal interactions and cultural connections continue today, and interregional coordination among tribal groups and families is an important aspect of the Plan. The Maidu are a community of people who have lived upon this land for untold generations (Cunningham 2007, p. 28). The ancestral homeland of the Mountain (Yamani) Maidu extends from Eagle Lake and Honey Lake in Lassen County east to Sierra Valley, south to the Feather River Canyon, and west to Mount Lassen (Cunningham 2015). Contemporary understanding of the traditional boundaries of tribal homelands is based on oral history and an incomplete archaeological record and so is necessarily approximated in published literature.

The Yamani Maidu ancestral homeland includes a wide range of mountain, valley, lake, spring, and stream environments that were used seasonally by the people and by neighboring tribes through extensive trading networks, resource stewardship agreements, and shared cultural values and extended family ties. Maidu depended on interactions with each other as well as surrounding tribes. Benefits of these interactions included shared resources, trade relations, and strengthened family ties. Through current policy and governance there has been a severe disruption in tribal relationships within the Maidu tribes, as well as with other tribes.

Oral histories of Maidu families place the estimated population of Yamani Maidu in the Upper Feather River watershed at around 22,000 people at the time of European contact, compared to an estimated 1,500 Maidu people today. The Maidu population was sustained by rigorous stewardship to maintain ecosystem health, species diversity, water resources, and beneficial interactions between people and place that provided for material well-being and spiritual progression. Stewardship of resources was coordinated by family units residing seasonally in various locations throughout the watershed (ibid.)

Following the arrival of large numbers of Europeans in the Sierra Nevada during the California Gold Rush, local Native Americans were dispossessed of their ancestral lands throughout the region. The Upper Feather River watershed includes areas covered by one of 18 treaties made between California Indians and the United States between 1851 and 1852 that were not ratified by the U.S. Senate. The areas covered by the un-ratified treaty include western Genesee Valley, Mount Hough, and parts of Indian Valley and American Valley (ibid.). There are currently two federally recognized Tribes (Greenville Indian Rancheria and Susanville Indian Rancheria), three federally unrecognized Tribes--the Tsi-Akim Maidu, the United Maidu Nation and Honey Lake Maidu are petitioning for federal recognition--and there are numerous trust allotment lands in the Upper Feather River watershed. The Greenville Rancheria is a federally recognized Tribe of Maidu Indians of California, located east of Greenville. Susanville Indian Rancheria's (SIR) land base is 1,340.74 acres, including one property in Plumas County located within the Upper

Feather River watershed. Tribes and bands associated with the SIR include Mountain Maidu, Northern Paiute, Washoe and Pit River whose ancestors lived in the northeastern California and northwestern Nevada region since time immemorial. Additionally, Tribes and tribal communities within the Butte County overlap area have strong interests in the Upper Feather River IRWM. This includes the areas around Pulga, Lake Concow, Lake Oroville, Feather Falls, and the rivers up to Bucks Lake.

There are thousands of significant Maidu cultural sites in the watershed, including the strong cultural ties by surrounding tribal communities to Homer Lake, which drains into the Mountain Meadows area in the Lake Almanor basin. Survey data are on file at the Plumas National Forest and the Northeast Information Center at California State University, Chico.

Maidu practitioners have long engaged in active management of ecological diversity including optimizing the health of plant and animal species, forests, and water through a continued intense relationship with the landscape. The surrounding environment provided all of the necessary nourishment, medicine, recreation, and spiritual development for thriving human communities. Intense interaction to ensure optimum health was practiced, including the use of landscape scale burning.

In recent history, the watershed has become severely impacted by mining, dams, hydroelectric production, agriculture, roadways, climate change, forestry practices, lack of active management, mining toxins, and changes in land use. Specific areas of concern include the Middle Fork beginning in Sierra Valley, Little Last Chance Creek, Red Clover Creek, Squaw Queen Creek, Little Indian Creek, Lights Creek, Hamilton Branch, the North Fork of the Feather River draining into Lake Almanor, the small tributaries and springs draining into Lake Almanor, Mud Creek, Yellow Creek, and Indian Jim in the Feather River Canyon. These small creeks and their tributaries represent areas directly affected by erosion and climate change, greatly affecting water quality downstream. Additionally, non-native species have been introduced into the waterways threatening and outcompeting native species.

Through sharing of Traditional Ecological Knowledge (TEK), Maidu practitioners hope to integrate their ancestral values into current and future watershed planning efforts, including implementation of the Upper Feather River IRWM Plan.

3.3.4 Economic Conditions and Trends

Median household income in the rural portion of the Plan Area is lower than the statewide average. Overall, with the exception of a few pockets of development within the region, communities in the UFR Region have a MHI less than 80 percent of the statewide average (Table 3-3). The 2013 median household income of $45,794 in Plumas County is lower than the statewide average of $61,094; MHI is lower for all levels of education, with the largest disparity among holders of graduate or professional degrees (Sierra Institute 2012). The map of disadvantaged communities within the Upper Feather River Region (Figure 3-4) continued decline in families with children and the increase in retirees living on fixed income is likely to widen the income disparity in the future. In recent history, the traditional economic base in Plumas County was the timber industry, which has been in decline since the late 1980s. Current economic trends are more favorable for agriculture, tourism, seasonal recreational developments, retail, and health services. The departure of families and upward shift in the age structure of the population is reflected in the closing of three elementary schools, one middle school, and two high schools in Plumas County since 2000 (ibid.) and is directly related to the decline of timber harvesting and wood processing jobs beginning in the late 1990s.

Because most communities in the watershed are very small, large percentage shifts in economic patterns can result from changes of only a few jobs. Unemployment in the Plan Area was 13.1 percent in March of

2015, which was down from a peak of 23.9 percent in 2010. Employment in the region has shifted from predominantly timber and agriculture to education, government agencies, retail, and health services. Employment by sector differs markedly among communities in the Plan Area because of small population sizes. Retail services account for most of the employment in tourism-oriented communities such as Graeagle and Chester, while education is the principal sector in Quincy, which is the location of Feather River Community College (Sierra Institute 2012).

3.3.5 Social and Cultural Values

The Yamani Maidu traditionally lived in seasonal settlements throughout the Upper Feather River watershed, occupied in harmony with the seasons. Permanent villages in mountain locations during the winter and predominately in lower elevation valleys provided shelter from winter storms and access to water and other natural resources. European settlements were at first highly ephemeral, concentrated at mining sites that were usually abandoned a few years after being established. Later settlements were more permanent, located at the most productive mines and around the timber mills and agricultural operations in the alluvial valleys and along railroad and stagecoach routes serving the mines and connecting agricultural and forest production enterprises to larger markets to the east and west.

Beginning in the early Twentieth Century, the potential of the Feather River for hydroelectric power generation was fully developed by Pacific Gas and Electric (PG&E); later the State Water Project began developing surface water storage in the watershed for water and hydroelectric needs statewide. This resulted in a complex and interconnected system of dams, powerhouses, and diversions, especially on the North Fork Feather River. More recent settlement patterns followed the development of tourism around the many lakes, valleys and free-flowing river segments in the region. Some of the largest lakes in the region, including Oroville, Almanor, and Butt Valley reservoir, were created by damming alluvial valleys and large meadows in parts of the North, Middle and South Forks of the Feather River for hydroelectric generation and water storage.

With a few exceptions, the Upper Feather River Region has maintained its rural character in the pre-automobile age through shared and cherished values around resource stewardship and community and individual self-reliance. The small population in the watershed has preserved a town-hall style of governance based on consensus-building, personal relationships, and informal lines of communication, as well as a relatively high level of civic engagement for its sparse population and lower-income status as compared to more urbanized regions in California (Plumas Co. 2009).

Branding day in Indian Valley, Plumas County (Source: SRWP)

The predominant land use in Plumas County and the portion of Lassen County in the Plan Area is open space, with approximately 94 percent of the private lands managed for timber, agriculture, and other commodity and amenity “open space” uses. The federally managed parts of the Region include the Bucks Wilderness area, the Lakes Basin recreation area and significant meadow, wetland, botanical and wildlife areas, which are conserved and managed for those purposes. State managed lands consist of the Plumas-Eureka State Park, which is managed primarily for passive recreation uses near the community of Blairsden. The Plumas County General Plan calls for land uses that facilitate recreation, community and business development consistent with residents’ values in relation to open space, preservation of landscape character, and resource protection and stewardship.

The portion of Sierra County in the Plan Area is mostly in Sierra Valley, a large complex of montane meadows the size of Lake Tahoe, which supports historic and modern agricultural and recreational developments and uses. Much of Sierra Valley is utilized for hay and livestock production.

The portion of Shasta County inside the Plan Area consists of parts of Lassen Volcanic National Park and has no residents. The portions of Tehama and Yuba counties inside the Plan Area are also unpopulated and consist of small pockets of back country where the county lines cross the topographic boundaries of the watershed. The portion of Butte County inside the Plan Area is mostly unpopulated and includes Plumas National Forest Lands, Lake Oroville, and the canyons of the North Fork and Middle Fork Feather River. Communities in Butte County located inside the Upper Feather River Region are focused more toward Sacramento Valley cities such as Chico and Oroville. Cultural affinities for the rural areas of the upper watershed are defined by water-based recreation including snow sports, the importance of seasonal movement of livestock between foothill winter ranges and summer pastures in the upland valleys for maintaining ranching livelihoods and lifestyles, and by the diversity of wildlife species that migrate to and from the foothills to the upland portions of the watershed with the seasons.

3.4 Environmental Setting

3.4.1 Climate and Precipitation

The Upper Feather River IRWM Plan Area lies in the northern Sierra Nevada, and generally has a Mediterranean climate characterized by hot dry summers and wet winters. Local climate varies markedly, due to the diversity of elevation, terrain, and aspect in the Plan Area. Because the Upper Feather River watershed has the unique property of lying on both sides of the Sierra Crest, precipitation is much lower in the eastern portion of the watershed than in the western portion. The western slope of the watershed receives up to 90 inches of precipitation per year, while the Sierra Valley floor receives as little as 11 inches. Precipitation also varies across the Region from north to south with the highest precipitation, runoff, and groundwater storage occurring as snow in the Cascade-Sierra zone.

3.4.2 Topography, Geology and Soils

Topography in the Plan Area is generally mountainous, but varied and complex. Elevation ranges from 900 feet at the surface of Lake Oroville, to over 10,400 feet at Lassen Peak. The crests of the Sierra Nevada and Diamond Mountains range from 6,000 to 7,000 feet, and the system of valleys forming the interior of the watershed generally slopes slightly upward to the southeast from 4,500 feet at Lake Almanor to approximately 5,000 feet in Sierra Valley. Peaks and ridges in this interior area are generally between 5,500 to 7,000 feet, but reach over 8,000 feet at Mount Ingalls.

The Upper Feather River watershed occupies the region of intersection between the Sierra Nevada, the Basin and Range, and the Cascades, all of which have very different geologic origins. The Sierra Nevada is characterized by granitic plutons formed by solidification of magma underground during the subduction under the Farallon Plate by the North American Plate, 115 to 87 million years before present, then uplifted by tilting of a block of crust between the Coast Ranges and the Basin and Range Province beginning approximately 10 million years before present (Schoenherr 1995). The Sierra Crest runs unbroken for over 400 miles from the northwest portion of the Plan Area to Tehachapi Pass in southern California, with continuous elevations between 8,000 and 14,000 feet for most of its length.

The Cascade Range is a series of active volcanoes formed by ongoing subduction of the Gorda and Juan de Fuca Plates by the North American Plate in the Cascadia Subduction Zone, which lies off the Pacific Northwest Coast between Cape Mendocino and Vancouver Island. Unlike the granitic Sierra Nevada, the volcanic Cascades consist of Andesitic and Basaltic lava that solidifies above-ground, forming high stratovolcanoes such as Mount Shasta, Mount Rainier, and Mount Lassen, or low, broad shield volcanoes such as the Medicine Lake highlands, depending on the chemical makeup of the erupting magma. In contrast to the Sierra Nevada, the Cascade Range is characterized by a generally elevated volcanic highland of 4,000 to 5,000 feet punctuated by isolated, conical peaks rising over 5,000 feet above the surrounding terrain. Most of the peaks in the Cascade Range are less than 2 million years old, and many are less than 100,000 years old (Harris 2005).

The Basin and Range Province is characterized by block faulting caused by crustal extension that results in a series of northwest trending, parallel mountain ranges separated by endorheic basins. These ranges contain a mix of granitic and sedimentary rocks, and the Province is associated with extensive volcanism. The Diamond Mountains are a western range of the Basin and Range, and formed through a process of block faulting along the eastern edge of the Sierra Nevada similar to that which formed the Carson Range and the Lake Tahoe Basin. Sierra Valley, which lies to the west of the Diamond Mountains, is a basin that once held a lake similar to Lake Tahoe, but is now filled with up to 2,000 feet of sediment.

The eastern escarpment of the Sierra Nevada south of the Middle Fork Feather River is formed by the Plumas Trench, which runs northwest from Sierra Valley, through Mohawk Valley, to the American Valley. The Plumas Trench is a graben, formed by faulting that raised the Sierra Nevada to the west and Grizzly Ridge and Beckwourth Peak to the east. East of Grizzly Ridge lie Grizzly Valley and Clover Valley, which are bounded on the east by the Diamond Mountains. Geology in the northern portion of the watershed is more complex, including the southern slopes of Mount Lassen, portions of the volcanic Modoc Plateau around Westwood, Wheeler Peak, Keddie Ridge, and the northern end of the Diamond Mountains.

South of the North Fork Feather River, the Sierra Crest divides the watershed into distinct western and eastern halves. The western half is dominated by the western slope of the Sierra Nevada, with streams flowing west through steep-sided, V-shaped, granitic canyons. The eastern half is dominated by the complex faulting and mix of granitic and volcanic geology described above, with streams flowing mainly northwest or southeast through broad, alluvial valleys formed by ice-age lakes. This part of the watershed contains numerous springs and montane wet meadow complexes that result from the flatter terrain and porous volcanic and alluvial soils.

Due to its complex geology, the watershed has diverse soils. In general, soils are deeper and more productive in the western portion, as a result of warmer temperatures and higher precipitation west of the Sierra Crest. Throughout the watershed, north-facing slopes tend to have deeper, more productive soils.

Many granitic soils are highly erosive. The erosion hazard to exposed soil is “high” on 29 percent of Plumas National Forest System lands; the majority of this high erosion hazard classification occurs in granitic soils. The volcanic rock and soils of the east side are susceptible to landslides; 14 percent of the Plumas National Forest is classified as “high” risk to landslides (ESF 2005, p. 4-10).

The complex intermountain and inter-province geology and soils in the region, in combination with the generally older and more weathered characteristics of mountains and valleys, is highly efficient at collecting and storing water; along with the Gold Rush, water production and conservation has shaped the history of the region and continues to significantly influence current and future land and water planning and management in the region to this day.

3.4.3 Terrestrial Ecosystems

According to the USDA CALVEG project, 52.1 percent of the watershed is covered by vegetation types that are classified by the CDFW California Wildlife Habitat Relationships System as Sierran mixed conifer series, including ponderosa pine (*Pinus ponderosa*), foothill pine (*Pinus sabiniana*), Douglas-fir (*Pseudotsuga menziesii*) and incense cedar (*Calocedrus decurrens*) alliances. In the upper elevations, the Sierran mixed conifer series gives way to the red fir (*Abies magnifica*) alliance, which covers 18.6 percent of the watershed (Table 3-4, Figure 3-5).

Table 3-4 Vegetation and Land Cover in the Upper Feather River Watershed IRWM Plan Area

Community1	Area (ac.)2	Percent of Plan Area
Sierran Mixed Conifer	1,200,583	52.1
Red Fir	429,118	18.6
Urban – Agriculture	175,664	7.6
Sagebrush	114,575	4.9
Mixed Chaparral	87,827	3.8
Jeffrey Pine	83,815	3.6
Montane Hardwood	73,800	3.2
Montane Chaparral	50,370	2.2
Water	46,612	2.0
Lodgepole Pine	11,534	0.5
Perennial Grass	9,835	0.4
Juniper	9,543	0.4
Barren	8,801	0.4
Blue Oak Woodland	4,156	0.2
Annual Grass	324	<0.1
Total	2,306,557	100.0

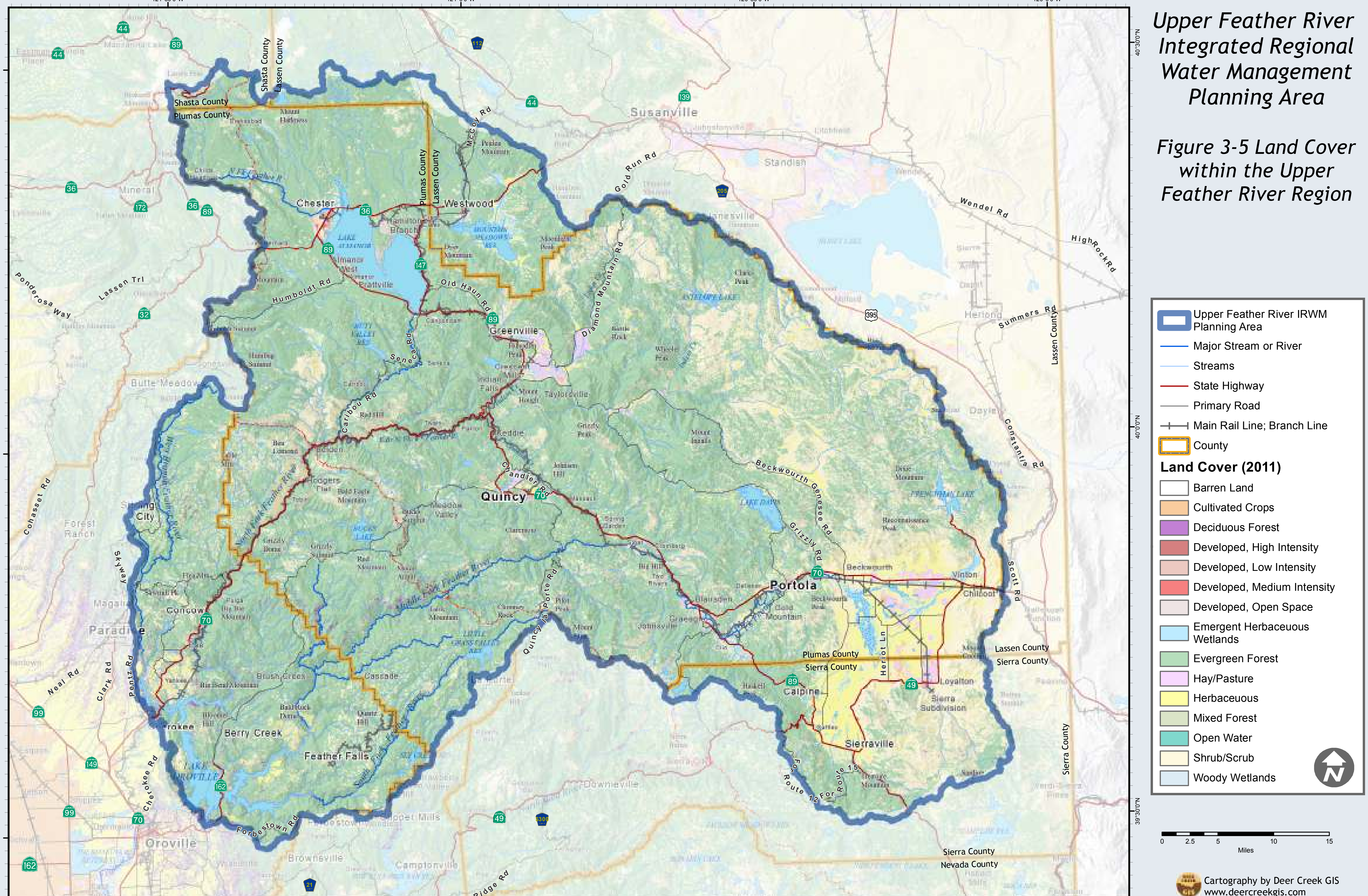
1Community names are from the California Wildlife Habitat Relationships System
2Area from CALVEG Project

The Urban-Agriculture cover-type is the third most extensive, covering 7.6 percent of the watershed. The majority of this cover type occurs as agriculture in Sierra Valley, Mohawk Valley, and the American Valley. Sagebrush (*Artemisia tridentata*) communities are found in east-side watersheds such as the Last Chance and Red Clover subwatersheds of the East Branch, and Sierra Valley in the Middle Fork. Sagebrush communities cover 4.9 percent of the watershed and are found on valley floors, where they are encroaching on meadows due to lowered water tables caused by stream incision and loss of riparian vegetation. Mixed chaparral, Jeffrey pine (*Pinus jeffreyi*), montane hardwood, and montane chaparral habitats occur throughout the watershed in small areas, cover between 2 and 4 percent of the watershed individually, and combine for approximately 13 percent cover. Lodgepole pine (*Pinus contorta*), blue oak (*Quercus douglasii*), juniper (*Juniperus* spp.), perennial grassland, annual grassland, and barren land cover less than 1 percent of the watershed each, and combine for approximately 2 percent total cover. The remaining 2 percent of the watershed is covered by open water in reservoirs and natural lakes.

All traditional species are important to Yamani Maidu. This includes direct human management and use, as companion plants for other plant species and pollinators, and as part of an integral ecological system including water health for the benefit of the entire ecosystem. The Yamani Maidu have maintained this landscape for untold generations both pre and post European contact. Restoration of species no longer present or in limited numbers is a desired condition from the tribal perspective of knowledge and place.

Upper Feather River Integrated Regional Water Management Planning Area

Figure 3-5 Land Cover within the Upper Feather River Region



3.4.4 *Aquatic Ecosystems and Fisheries*

The Upper Feather River Watershed has a wide variety of aquatic habitats including natural ponds and lakes, reservoirs and canals, springs and meadows, small alpine streams, and large, canyon-bounded rivers. The fisheries of the watershed are also varied with numerous species of native and non-native fish occupying the varied habitats. Fisheries in the watershed can be generalized into two categories: cold water streams and rivers, and cold and warm water lakes and reservoirs.

The transitional geology of the Feather River basin includes extensive Cascadian formations that provide widespread springs. These springs supply substantial year-round, cold-water summer base flow to many streams and rivers. The largest and most important springs in the Upper Feather watershed are the Big Springs on the North Fork Feather River, which were inundated in 1914 by Lake Almanor. These springs, whose water originates from as far away as the southern slopes of Mount Lassen, provide between 800 and 1000 cubic feet per second (cfs) of year-round flow. Many other springs in the watershed also provide important year-round sources of cold water to such waterways as the upper North Fork Feather River upstream of the current Lake Almanor, the Hamilton Branch of the North Fork Feather River, Butt Creek, Yellow Creek, and many smaller streams.

3.4.4.1 Historical Salmon and Steelhead in the Upper Feather River Watershed

Historically, the Upper Feather River Watershed provided spawning habitat to anadromous Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*), that migrated from the Pacific Ocean to spawn in the headwaters streams of the Feather River. The North Fork Feather provided the greatest and most productive anadromous fish habitat, with salmon reaching as far upstream as about two miles above Seneca, and in some cases to the present location of Lake Almanor (Yoshiyama 2001, p. 124). Curtain Falls on the Middle Fork Feather posed a barrier to upstream migration. The South Fork Feather featured ample spawning habitat, but irrigation diversions near the current high water mark of Oroville Reservoir blocked passage on the South Fork Feather before 1929 (ibid, pp. 125-126).

Curtain Falls, Middle Fork Feather River
Source: www.americanwhitewater.org

The construction of Big Bend Dam in 1910 to serve the Big Bend powerhouse 11 miles downstream partly blocked the migration of salmon and steelhead on the North Fork Feather River. Although there was a fish ladder over Big Bend Dam, water was bypassed out of the river into pipes, and the North Fork Feather was at times largely dewatered for these 11 miles during periods of relatively low water (Brehm 1996, Wales and Hansen 1952, p.1).

The Oroville Dam now blocks the upstream migration of salmonids at a point further downstream. Oroville Reservoir inundated much of the remaining salmonid spawning habitat, particularly for spring-run Chinook and steelhead. Ocean-run salmonids are no longer present in the watershed above the dam. The Feather River Fish Barrier Dam, located just downstream of Oroville Dam, now diverts migrating salmon and steelhead to the Feather River Fish Hatchery Ladder, where they are collected for artificial spawning.

One-year-old hatchlings are released into the Feather River or transported downstream to the Delta where they migrate to the Pacific Ocean until returning to the lower Feather River to spawn as adults (ESF 2005, p. 4-29).

There have been proposals by the National Marine Fisheries Services (NMFS) to reintroduce steelhead and salmon to the North Fork Feather River watershed through a trap and haul program, but the current Habitat Expansion Agreement between NMFS, DWR, and PG&E has moved away from the North Fork Feather River watershed--at least for the present (Plumas Co. 2009, p. 20).

Tribal representatives advocate for restoring salmon and other native fish species in the watershed of the Upper Feather River region. The Maidu people are proponents of working in collaborative stewardship to assist in fish restoration, utilizing cultural knowledge and including historical precedence and traditional practices for fostering fish passage.

3.4.4.2 North Fork Feather River Fisheries and Hydropower Development

Following the extirpation of salmon and steelhead from the North Fork Feather, the river nonetheless remained one of the premier recreational trout fisheries in California. Prior to the completion of Highway 70 up the [North Fork] Feather River Canyon in 1937, anglers came on the Western Pacific Railroad to fish the North Fork (Wixom 1989.). In 1952 there were 11 fishing resorts along the North Fork prior to the completion of the Rock Creek – Cresta Hydroelectric Project in 1950. Estimated angler days in 1946 were 36,000, and estimated annual catch of trout was 108,000 (Wales and Hansen 1952, pp. 10-11).

The fishery changed dramatically with the construction and operation of the Rock Creek – Cresta Project. The new a flow regime on the Rock Creek and Cresta reaches left only 50 to 100 cfs in the river, diverting all the rest into tunnels leading to the powerhouses. This "bypass" of 90-95 percent of the river flow was relieved only during power system outages and periods of uncontrolled high flows. By 1989, the trout fishery on both the Rock Creek and Cresta reaches had been severely diminished, and warm water fish had largely displaced trout. Chemical treatments removed most of the fish in these reaches in 1966 and again in 1977, but the benefit to trout was small and short-lived (Wixom 1989, p. 6). By 1982, there was little spawning gravel left in the Rock Creek and Cresta reaches of the North Fork. Much gravel had been captured by forebay dams along the river (ibid, p. 7). Gravel introduced from tributaries was washed into downstream reservoir during high flow events.

The North Fork fishery began a reset in 2001 with the Federal Energy Regulatory Commission's (FERC) relicensing of the Rock Creek – Cresta Project. Under the Rock Creek – Cresta Settlement Agreement that grew out of the relicensing, streamflows were improved and water temperatures were slightly improved. Although trout are still outnumbered by warm water species in both the Rock Creek and Cresta reaches, trout abundance has increased, and fish greater in length than 17 inches are regularly reported. Implementation of catch-and-release, no-bait angling regulations, while not universally obeyed, has also helped to sustain the fishery. In 2007, PG&E completed an artificial spawning channel near its facility at Rodgers Flat on the Rock Creek reach, and monitoring shows steadily increasing use by rainbow trout. Gravel augmentations in several tributaries on the reach have also achieved measurable improvements at relatively low cost. Currently, the Forest Service is planning passage improvements to several additional tributaries along the Rock Creek reach and on the East Branch of the North Fork.[1] Two fishing guides have Forest Service use permits for the North Fork Feather.

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[1] Information on the Rock Creek – Cresta Project since 2001 was developed from PG&E's annual reports to FERC on the operation of the Rock Creek – Cresta Project. See for example the 2015 Annual Report at FERC's eLibrary, www.ferc.gov, accession no. 20160524-5131.

Upstream of the Rock Creek – Cresta Project is the Upper North Fork Feather Hydroelectric Project, which includes the 1.13 million acre-foot reservoir Lake Almanor, as well as Butt Valley Reservoir and the Seneca and Belden reaches of the North Fork Feather River. Lake Almanor, Butt Valley Reservoir and Caribou I Powerhouse at the bottom of the Seneca reach were developed in the early 1900's. Butt Valley Powerhouse on Butt Valley Reservoir, Caribou II Powerhouse adjacent to Caribou I, and Belden Powerhouse just upstream of Rock Creek Reservoir were added in 1958. This project also went through relicensing in the late 90's and early 2000's, and a partial settlement agreement was signed in 2004.

Lake Almanor is the most prolific and most popular fishery in the Upper Feather watershed. Its cold-water species feature rainbow trout, brown trout and land-locked Chinook salmon. The lake also features warm-water species, notably smallmouth bass. The sportfish population is supported by wakasagi, Japanese pond smelt imported to California, that provide a forage fish base for larger species, as well as by a rich insect life including the very large Hexagenia mayfly. The pond smelt in particular promote rapid growth of the trout, salmon and bass. Lake Almanor features nine licensed fishing guides and many resorts, businesses and campgrounds that cater to anglers. A locally sponsored net-pen rearing program for juvenile fish, located near the mouth of the Hamilton Branch, augments fish plantings by the California Department of Fish and Wildlife. The Upper North Fork Feather Settlement Agreement includes a lake level agreement to protect the fishery, visual quality and other values of Lake Almanor from rapid drawdown of the lake during the summer.

Butt Valley Reservoir, southwest of Lake Almanor, is formed by a dam on spring-fed Butt Creek. However most of its water comes from a PG&E pipe that moves water from Lake Almanor (at Prattville) through Butt Valley Powerhouse, located at the upper end of Butt Valley Reservoir. The reservoir supports a popular fishery of large trout, as well as bass, both of which feed on pond smelt.

From Butt Valley Reservoir, water is released through enormous pressurized pipes ("penstocks") down to the Caribou powerhouses located on the North Fork Feather River at the bottom of the Seneca reach, 10.8 river miles downstream of Lake Almanor's Canyon Dam (FERC 2005). The FERC-required flow release from Canyon Dam into the North Fork Feather is only 35 cfs. All the rest of the water from Lake Almanor passes through Prattville and Butt Valley Reservoir. Largely because water heats considerably in Butt Valley Reservoir, the water that enters the North Fork Feather downstream of the Seneca reach and the Caribou powerhouses is thus much warmer than it was under pre-project conditions.

Because it is in a deep, shaded canyon, and because it draws water from near the bottom of Lake Almanor, the Seneca reach of the North Fork Feather is cold, and features a good trout fishery. However, since more than 95 percent of its flow is diverted, the former river is now more a mid-size mountain stream. Access to most of the reach is limited and difficult.

The Belden reach of the North Fork Feather, downstream of the Caribou powerhouses, is regulated by Belden Forebay, a small reservoir into which the two Caribou powerhouses discharge their outfall. The regulating reservoir allows PG&E to maintain a relatively constant flow in the river downstream, even though the powerhouses are ramped up and down at different times to meet various needs on the power grid. As with the other reaches of the North Fork Feather below Almanor, most of the water is piped around the Belden reach, and only rejoins the river at the outfall of Belden Powerhouse, just upstream of Rock Creek Reservoir. The Belden reach is easily accessible from Caribou Road, and the California Department of Fish and Wildlife maintains the reach as a put and take fishery through stocking. However, vegetation encroachment into the stream channel, the result of lack of flushing flows, makes it hard to get to the river along much of the reach.

Neither the FERC relicensing of the Upper North Fork Feather Project, nor the Upper North Fork Settlement Agreement addressed water temperature. The State Water Resources Control Board was left the difficult problem of improving water temperatures in the North Fork Feather River through its issuance of a Water Quality Certification for the relicensing of the Upper North Fork Feather Project. The State Board issued an Environmental Impact Report in November, 2014, that analyzed an option to install a "thermal curtain" at PG&E's Prattville intake. However, this approach has been universally reviled in Plumas County due to concerns that this facility would pull the cold water out of the lake and harm the lake's trout fishery. Due in large part to the overwhelming negative response in the county, State Board staff is preparing a new EIR for release in 2017.

Poe Project downstream of Cresta Powerhouse

Cresta Powerhouse discharges its outfall into Poe Reservoir, from which a tunnel diverts water down to the Poe Powerhouse, upstream of the high water mark of Oroville Reservoir. The Poe reach of the North Fork Feather River is a transitional in temperature, reliably cold only for one to two miles at the top of the reach. The Poe reach is noteworthy for its robust population of foothill yellow-legged frogs (*rana boylii*), a Forest Service species of special concern. In some years, surveys conducted by consultants to PG&E have detected over foothill yellow-legged frog egg masses during the late spring breeding season. This population is one of the most robust in the Sierras, and will be a management priority in the soon-to-be-issued Water Quality Certification for the relicensing of the Poe Project and in the implementation of the new FERC license itself.[2]

3.4.4.3 Middle Fork Feather River: Wild and Scenic

Over 70 miles of the Middle Fork Feather River were designated under the Wild & Scenic Rivers Act in 1968, and 30 river miles are inaccessible by road (Natl. Wild Rivers 1968). The Middle Fork features an excellent rainbow trout fishery over much of its length, and a several fishing guides work its waters. Downstream of Mohawk Valley, access is largely by walk-in or kayak. A road provides access to anglers and kayakers at Milsap Bar.

Middle Fork Feather River, Wild and Scenic
Source: www.americanwhitewater.org

3.4.4.4 Davis Lake

Davis Lake north of Portola is a reservoir on Grizzly Creek, one of the highest elevation tributaries of the Middle Fork Feather River. Davis Lake is heavily planted with rainbow trout by the Department of Fish and Wildlife as both a put-and-take and put-and-grow fishery. Davis Lake features some of the fastest growth rates in California, due in part to aquatic snails in its food base. Davis Lake is very popular both among fly and spin anglers, and several guides work its waters with their clients.

There are many other notable fisheries in the upper Feather watershed. The North Fork Feather upstream of Lake Almanor and Bucks Lake warrant mention. Spring creeks such as Yellow Creek and many smaller spring creeks offer a variety of fisheries, as well as enhancement and restoration opportunities.

[2] For further documentation of foothill yellow-legged frogs on the Poe reach, see Annual Reports for the Rock Creek – Cresta Project, as cited above.

Fisheries in the Upper Feather River Watershed are managed by the California Department of Fish and Wildlife (CDFW) and the DWR. Fisheries management has included stocking and removals at several locations in the watershed, and introduced game species have migrated into most streams and lakes in the watershed. A collaborative (Trout Unlimited, Sierra Institute, Plumas, Lassen and Tahoe National Forests and California Department of Fish and Wildlife) assessment of fish distribution and habitat conditions is currently underway.

There are currently 24 common fish species known to occur in the Upper Feather River Watershed (ESF 2005), of which 13 are non-native (Table 3-5). The actual extent and distribution of these species is generally unclear.

Table 3-5 Common fish species in the Upper Feather River Watershed IRWM Plan Area

Common Name	Scientific Name
Rainbow Trout	*Oncorhynchus mykiss*
Eagle Lake Rainbow Trout	*Oncorhynchus mykiss aquilarum*
Eastern Brook Trout	*Salvelinus fontinalis**
Brown Trout	*Salmo trutta**
Lake Trout (Mackinaw)	*Salvelinus namaycush**
Chinook salmon (landlocked)	*Oncorhynchus tshawytscha*
Kokanee Salmon	*Oncorhynchus nerka**
Sacramento pikeminnow	*Ptychocheilus grandis*
Sacramento sucker	*Catostomus occidentalis*
Carp	*Cyprinus carpio**
Channel Catfish	*Ictalurus Punctatus**
Hardhead	*Mylopharodon conocephalus*
Sculpin	*Cottus spp.*
Hitch	*Lavinia exilicauda*
Speckled Dace	*Rhinichthys osculus*
California Roach	*Hesperoleucus symmetricus*
Brown Bullhead	*Ameiurus nebulosus**
Sacramento Perch	*Archoplites interruptus*
Bluegill	*Lepomis macrochirus**
Redear Sunfish	*Lepomis microlophus**
Green Sunfish	*Lepomis cyanellus**
Black Crappie	*Pomoxis nigromaculatus**
Largemouth Bass	*Micropterus salmoides**
***Non-native**	

In general, headwater stream habitats in the Upper Feather River watershed support various salmonid species (rainbow, brown, and brook trout) and freshwater sculpin (*Cottus spp*.). As one travels downstream and water temperatures increase, brown and brook trout become sparse and native species such as Sacramento sucker, Sacramento pikeminnow, and hardhead become more abundant. Summer water temperatures in main stem streams/rivers are generally higher than historic averages primarily due to dam/reservoir construction that slows water flow. As a result, many stream reaches below dams that were historically dominated by cold-water species are now shared between cold- and warm-water species, or are entirely dominated by warm-water species.

Lake and reservoir fisheries mostly consist of introduced/non-native species, and are highly varied across the watershed. Most lakes above 5,000 feet elevation are considered cold-water habitat and support salmonids such as rainbow, brown, brook, and lake (mackinaw) trout. California Department of Fish and Wildlife (CDFW) supports most lake/reservoir salmonid populations through stocking efforts, though many reservoirs with sufficient cold water inflows allow for spawning support and self-sustaining populations of salmonids. Lakes and reservoirs below 5,000 feet are typically warmer than those above this elevation, and non-native species such as smallmouth bass, largemouth bass, brown bullhead, and various sunfish species are present along with salmonids. Non-salmonid species such as smallmouth and largemouth bass are self-sustaining where present. Native species such as Sacramento pikeminnow, Sacramento sucker, and California roach also utilize reservoir habitats, and these reservoirs tend to support these species at higher elevations than they would normally be found. At least three reservoirs in the watershed (Mountain Meadows Reservoir, Lake Almanor, and Butt Valley Reservoir) support Sacramento perch, the only sunfish species native west of the Rocky Mountains and listed as a California Species of Special Concern.

Stream, lake, and reservoir fisheries in the Upper Feather River watershed are very popular with anglers, and visiting anglers can be a significant source of revenue for the rural communities situated near these fisheries. As a result, local communities view fisheries management within the Upper Feather River watershed as a high priority, with many communities actively engaged with CDFW in helping to provide improved sport fishing opportunities in area streams, lakes, and reservoirs.

3.4.5 Endangered and Special-Status Species

The Upper Feather River IRWM Plan Area includes five special-status habitats, 25 special-status animal species, and 66 special-status plant species with reported occurrences in the California Natural Diversity Database (CNDDB; Table 3-6). Special-status animal species in the Plan Area include five invertebrates, four amphibians, one reptile, eight birds, and seven mammals. Special-status species are species that are listed or candidates for listing under the Federal or State Endangered Species Acts, species of special concern to federal or State resource management agencies, and plants that have a California Rare Plant Rank of 1B or 2B, indicating that they are rare, threatened, or endangered in California. Special-status habitats are either rare or contain a high concentration of special-status species.

There are CNDDB-reported occurrences in the Plan Area of three federally-listed animals and two federally listed plants: valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), California red-legged frog (*Rana aurora draytonii*), Sierra Nevada yellow-legged frog (*Rana sierrae*), Webber's ivesia (*Ivesia webberi*), and slender orcutt grass (*Orcuttia tenuis*). There are CNDDB-reported occurrences for six species that are State-listed only, with no federal listing: willow flycatcher (*Empidonax traillii*; the southwestern subspecies *E. t. extimus* is federally-listed), greater sandhill crane (*Grus canadensis tabida*), and bank swallow (*Riparia riparia*).

Habitat for the valley elderberry longhorn beetle extends to approximately the 3,000 foot elevation contour on the western slope of the Sierra Nevada; therefore, suitable habitat for this species in the Plan Area is restricted to the extreme western portion around Lake Oroville. Additionally, there is currently suitable habitat in T23 NE, R5E, S32, well above Lake Oroville. Webber's ivesia is reported in the Plan Area only in the Sierra Valley area.


Sandhill Crane (Courtesy of Kristi Jamason)

Special-status habitats in the Region are: Darlingtonia seep, montane freshwater marsh, northern interior cypress forest, northern vernal pool, and Sphagnum fen. Darlingtonia seeps support rare insectivorous plants such as California pitcher plant (*Darlingtonia californica*) and sundews (*Drosera* spp.) that obtain Nitrogen by trapping and digesting insects, and occur in the Plan Area in the East Branch of the North Fork and Spanish Creek subwatersheds. Montane freshwater marsh habitats were once extensive in the high-elevation valleys in the Region but have been reduced through draining for agriculture, early sluice mining operations, and from the widespread extirpation of beaver from the UFR during the fur-trading era of the early 1800s. Northern interior cypress forest occurs in the Lights Creek and Upper Indian Creek subwatersheds. Also occurring in the region, serpentine soils containing levels of iron and magnesium are toxic to most plants, are nutrient-poor, and have very low water retention, which has led to the evolution of a unique flora of serpentine endemic plant species able to tolerate the harsh conditions.

Vernal pools are shallow seasonal wetlands that form under special conditions of heavy soils with a restrictive layer that retards drainage, and flat topography that forms micro-basins. Vernal pools form in the spring and retain water far longer than surrounding terrain. The seasonal inundation and gradual drying of vernal pools has resulted in the evolution of a unique endemic flora that is distinct from immediately surrounding areas. Sphagnum fens support thick, spongy layers of living and dead moss (*Sphagnum* spp.) that form highly acidic, nutrient-poor, permanently waterlogged peat soils. A Sphagnum fen occurs in the southwest part of the Yellow Creek subwatershed.

Table 3-6. Special-Status Species and Habitats in the Upper Feather River IRWM Plan Area[1]

Life Form	Scientific Name	Common Name	Status[2]	Number of Occurrences[3]
Habitat	--	Darlingtonia seep	--/--	7
Habitat	--	montane freshwater marsh	--/--	2
Habitat	--	northern interior cypress forest	--/--	2
Habitat	--	northern vernal pool	--/--	4
Habitat	--	Sphagnum fen	--/--	1
Invertebrate	*Desmocerus californicus dimorphus*	valley elderberry longhorn beetle	FT/--	1
Invertebrate	*Ecclisomyia bilera*	Kings Creek ecclysomylan caddisfly	--/--	1
Invertebrate	*Hydroporus leechi*	Leech's skyline diving beetle	--/--	1
Invertebrate	*Neothremma genella*	golden-horned caddisfly	--/--	1
Invertebrate	*Parapsyche extensa*	Kings Creek parapsyche caddisfly	--/--	1
Amphibian	*Rana aurora draytonii*	California red-legged frog	FT/--	2
Amphibian	*Rana boylii*	foothill yellow-legged frog	--/--	5
Amphibian	*Rana cascadae*	cascades frog	--/--	13
Amphibian	*Rana muscosa*	mountain yellow-legged frog	FE/--	16
Reptile	*Actinemys marmorata marmorata*	northwestern pond turtle	--/--	2
Bird	*Accipiter gentilis*	northern goshawk	--/--	46
Bird	*Cypseloides niger*	black swift	--/--	1
Bird	*Empidonax traillii*	willow flycatcher	--/SE	16
Bird	*Grus canadensis tabida*	greater sandhill crane	--/ST	43
Bird	*Haliaeetus leucocephalus*	bald eagle	FDL/SE	30
Bird	*Pandion haliaetus*	osprey	--/--	40
Bird	*Riparia riparia*	bank swallow	--/ST	3

Life Form	Scientific Name	Common Name	Status[2]	Number of Occurrences[3]
Bird	*Strix nebulosa*	great grey owl	--/SE	1
Mammal	*Gulo gulo*	California wolverine	--/ST	3
Mammal	*Lasiurus blossevillii*	western red bat	--/--	1
Mammal	*Lepus americanus tahoensis*	Sierra Nevada snowshoe hare	--/--	1
Mammal	*Martes americana*	pine marten	--/--	10
Mammal	*Martes pennanti pacifica*	Pacific fisher	FC/SC	13
Mammal	*Taxidea taxus*	American badger	--/--	9
Mammal	*Vulpes vulpes necator*	Sierra Nevada red fox	--/ST	5
Plant	*Agrostis hendersonii*	Henderson's bent grass	--/--	3
Plant	*Allium jepsonii*	Jepson's onion	--/--	15
Plant	*Astragalus lemmonii*	Lemmon's milk-vetch	--/--	2
Plant	*Astragalus lentiformis*	lens-pod milk-vetch	--/--	55
Plant	*Astragalus pulsiferae var. pulsiferae*	Pulsifer's milk-vetch	--/--	17
Plant	*Astragalus tener ver. ferrisiae*	Ferris's milk-vetch	--/--	1
Plant	*Astragalus webberi*	Webber's milk-vetch	--/--	11
Plant	*Balsamorhiza macrolepis var. macrolepis*	big-scale balsamroot	--/--	1
Plant	*Betula pumila var. glandulifera*	resin birch	--/--	2
Plant	*Boechera constancei*	Constance's rock-cress	--/--	50
Plant	*Bruchia bolanderi*	Bolander's brachia	--/--	2
Plant	*Calystegia atriplicifolia ssp. buttensis*	Butte County morning-glory	--/--	6
Plant	*Carex lasiocarpa*	slender sedge	--/--	6
Plant	*Carex limosa*	shore sedge	--/--	8
Plant	*Carex petasata*	Liddon sedge	--/--	1
Plant	*Carex sheldonii*	Sheldon's sedge	--/--	14
Plant	*Clarkia biloba ssp. brandegeeae*	Brandegee's clarkia	--/--	2
Plant	*Clarkia gracilis ssp. albicaulis*	white-stemmed clarkia	--/--	6
Plant	*Clarkia mildrediae ssp. mildrediae*	Mildred's clarkia	--/--	39
Plant	*Clarkia mosquinii*	Mosquin's clarkia	--/--	41
Plant	*Corallorhiza trifida*	northern coralroot	--/--	1
Plant	*Drosera anglica*	English sundew	--/--	9
Plant	*Eleocharis torticulmis*	California twisted spikerush	--/--	2
Plant	*Epilobium howellii*	subalpine fireweed	--/--	1
Plant	*Epilobium luteum*	yellow willowherb	--/--	1
Plant	*Epilobium palustre*	marsh willowherb	--/--	1
Plant	*Erigeron nevadincola*	Nevada daisy	--/--	4
Plant	*Eriogonum spectabile*	Barron's buckwheat	--/--	2
Plant	*Fritillaria eastwoodiae*	Butte County fritillary	--/--	47
Plant	*Hulsea nana*	little hulsea	--/--	2

Life Form	Scientific Name	Common Name	Status[2]	Number of Occurrences[3]
Plant	*Ivesia aperta var. aperta*	Sierra Valley ivesia	--/--	40
Plant	*Ivesia baileyi var. baileyi*	Bailey's ivesia	--/--	6
Plant	*Ivesia sericoleuca*	Plumas ivesia	--/--	34
Plant	*Ivesia webberi*	Webber's ivesia	FT/--	3
Plant	*Juncus leiospermus var. leiospermus*	Red Bluff dwarf rush	--/--	1
Plant	*Lewisia cantelovii*	Cantelow's lewisia	--/--	29
Plant	*Lomatium foeniculaceum var. macdougalii*	MacDougal's lomatium	--/--	2
Plant	*Lomatium hendersonii*	Henderson's lomatium	--/--	3
Plant	*Lupinus dalesiae*	Quincy lupine	--/--	158
Plant	*Mielichhoferia tehamensis*	Lassen Peak copper-moss	--/--	1
Plant	*Monardella douglasii ssp. venosa*	veiny monardella	--/--	1
Plant	*Monardella follettii*	Follett's monardella	--/--	28
Plant	*Monardella stebbinsii*	Stebbins's monardella	--/--	8
Plant	*Orcuttia tenuis*	slender orcutt grass	FT/SE	4
Plant	*Oreostemma elatum*	tall alpine-aster	--/--	10
Plant	*Penstemon janishiae*	Janish's beardtongue	--/--	3
Plant	*Penstemmon personates*	closed-throated beardtongue	--/--	22
Plant	*Potamogeton epihydrus ssp. nuttallii*	Nuttall's pondweed	--/--	1
Plant	*Potamogeton praelongus*	white-stemmed pondweed	--/--	1
Plant	*Pyrrocoma lucida*	sticky pyrrocoma	--/--	53
Plant	*Rhynchospora alba*	white beaked-rush	--/--	3
Plant	*Rhynchospora capitellata*	brownish beaked-rush	--/--	4
Plant	*Sagittaria sanfordii*	Sanford's arrowhead	--/--	1
Plant	*Scheuchzeria palustris var. americana*	American scheuchzeria	--/--	4
Plant	*Schoenoplectus subterminalis*	water bulrush	--/--	6
Plant	*Scutellaria galericulata*	marsh skullcap	--/--	3
Plant	*Sedum albomarginatum*	Feather River stonecrop	--/--	16
Plant	*Senecio eurycephalus var. lewisrosei*	cut-leaved ragwort	--/--	30
Plant	*Silene occidentalis ssp. longistipitata*	long-stiped campion	--/--	1
Plant	*Silene suksdorfii*	Cascade alpine campion	--/--	2
Plant	*Solidago gigantea*	smooth goldenrod	--/--	1
Plant	*Stachys palustris ssp. pilosa*	marsh hedge nettle	--/--	1
Plant	*Stanleya viridflora*	green-flowered prince's plume	--/--	1
Plant	*Trimorpha acris var. debilis*	northern daisy	--/--	2
Plant	*Utricularia intermedia*	flat-leaved bladderwort	--/--	9
Plant	*Utricularia ochroleuca*	cream-flowered bladderwort	--/--	2

Life Form	Scientific Name	Common Name	Status[2]	Number of Occurrences[3]
[1]**Source**: CNDDB, 2005, as reported in ESF, 2005.				
[2]Status: F=Federal Listing; S=State Listing; E=Endangered; T=Threatened; C=Candidate; DL=Delisted				
[3]Number of CNDDB reported occurrences as of 2005				

3.4.6 Invasive Species

Invasive species and noxious weeds are found throughout the watershed. These species affect native communities and many are agricultural pests. Governing districts and local stakeholders have made control and eradication of non-native and invasive species a top priority. Invasive weeds are considered a major problem in the watershed for their increasing potential to adversely affect the agricultural and recreational economy and natural environment. A number of invasive species have had significant negative impacts in the watershed by outcompeting native plant and animal species, altering the natural fire frequency and severity, lowering crop production, decreasing available water supplies, reducing rangeland productivity, hindering recreational opportunities, and increasing the potential for erosion. Common noxious weeds found throughout the watershed include: yellow star thistle (*Centaurea solstitialis*), medusahead (*Elymus caput-medusae*), musk thistle (*Carduus nutans*), perennial pepperweed (*Lepidium latifolium*), and scotch broom (*Cytisus scoparius*). Table 3-7 lists the managed noxious weeds within the region.

Table 3-7 Noxious Weeds Managed by the Plumas-Sierra County Department of Agriculture

Common Name	Scientific Name
Musk thistle	*Carduus nutans*
Spotted knapweed	*Centaurea stoebe*
Diffuse knapweed	*Centaurea diffusa*
Russian knapweed	*Rhaponticum repens*
Russian thistle	*Salsola targus*
Dalmatian toadflax	*Linaria dalmatica*
Dyer's woad	*Isatis tinctoria*
Tall whitetop (a.k.a. perennial pepperweed)	*Lepidium latifolium*
Yellow star thistle	*Centaurea solstitialis*
Hoary cress	*Cardaria sp.*
Rush skeletonweed	*Chondrilla juncea*
Scotch thistle	*Onopordum acanthium*
Scotch broom	*Cytisus scoparius*
French broom	*Genista monspessulana*
Spanish broom	*Spartium junceum*
Stinkwort	*Dittrichia graveolens*
Canada thistle	*Cirsium arvense*
Bull thistle	*Cirsium vulgare*
Tree of heaven	*Ailanthus altissima*
Field bindweed	*Convolvulus arvensis*
Leafy spurge	*Euphorbia virgata* (nearly eradicated)
Salt cedar	*Tamarix sp.* (nearly eradicated)
Mediterranean Sage	*Salvia aethiopis* (nearly eradicated)
Medusahead	*Taeniatherum caput-medusae*

Common Name	Scientific Name
Sulfur cinquefoil	*Potentilla recta*
Klamath weed	*Hypericum perforatum* (mostly under biological control)
Barbed goatgrass	*Aegilops triuncialis*
Jointed goatgrass	*Aegilops cylindrica*
Ovate goat grass	*Aegilops ovata*
Puncture vine	*Tribulus terrestris*
Eurasian watermilfoil	*Myriophyllum spicatum*
Common tansy	*Tanacetum vulgare*
Fennel	*Foeniculum vulgare*
Poison hemlock	*Conium maculatum*
Russian olive	Elaeagnus angustifolia
Italian thistle (found only in Butte County portion of UFR Region)	*Carduus tenuiflorum*
Source: Plumas-Sierra Counties Agricultural Commissioner, November 2015.	

3.4.7 Role of Wildfire

Forest and chaparral ecosystems in the northern Sierra Nevada region have evolved with a natural fire ecology characterized by frequent, localized, low and moderate intensity fires. Water management in the region includes widespread interest in the reintroduction of low and moderate intensity fire. Indigenous peoples deliberately burned at varied fire intensities and at variable "fire return" intervals for optimal species habitats and for landscape-scale ecological enhancement which benefited the People and animals. The use of fire in this way had multiple benefits. It kept the forest open in a park-like setting, protecting the region from catastrophic forest fires, increased understory species, ensured rapid nutrient cycling, decreased diseases, and enhanced benefit for multiple plant and animal species (Cunningham 2007, p. 29). Many shrub species resprout from below-ground crowns following a fire, and many tree species require low-intensity fire to trigger seed germination. Forest management practices starting with the arrival of Europeans in the mid-1800s focused on fire suppression and resulted in substantial buildup of biomass over historic conditions. Drought, disease, and pests have combined to convert that increased biomass into volatile fuel. In recent decades, with the ecological trends of more widespread and severe fires, there are serious threats to human lives and property from severe wildfires when residential development expands into high fire hazard forested areas.


Chips Fire, 2012 (Source: USFS)

In combination, wind, steep terrain, and water-stressed trees and highly flammable forest fuels all contribute to increasing wildland fire hazard threats to residential homes, recreational developments, and whole communities located within forests. The California Department of Forestry and Fire Protection has designated a majority of the Plan Area as having a very high fire hazard rating.

In a changing climate, the role of Traditional Ecological Knowledge (TEK) becomes even more important, specifically the reintroduction of fire as maintenance of water resources. TEK has sustained the Maidu through prolonged droughts based on traditions of understanding relations between fire, water, and location.

3.5 Description of Watersheds and Water Systems

3.5.1 *Watersheds and Groundwater Basins*

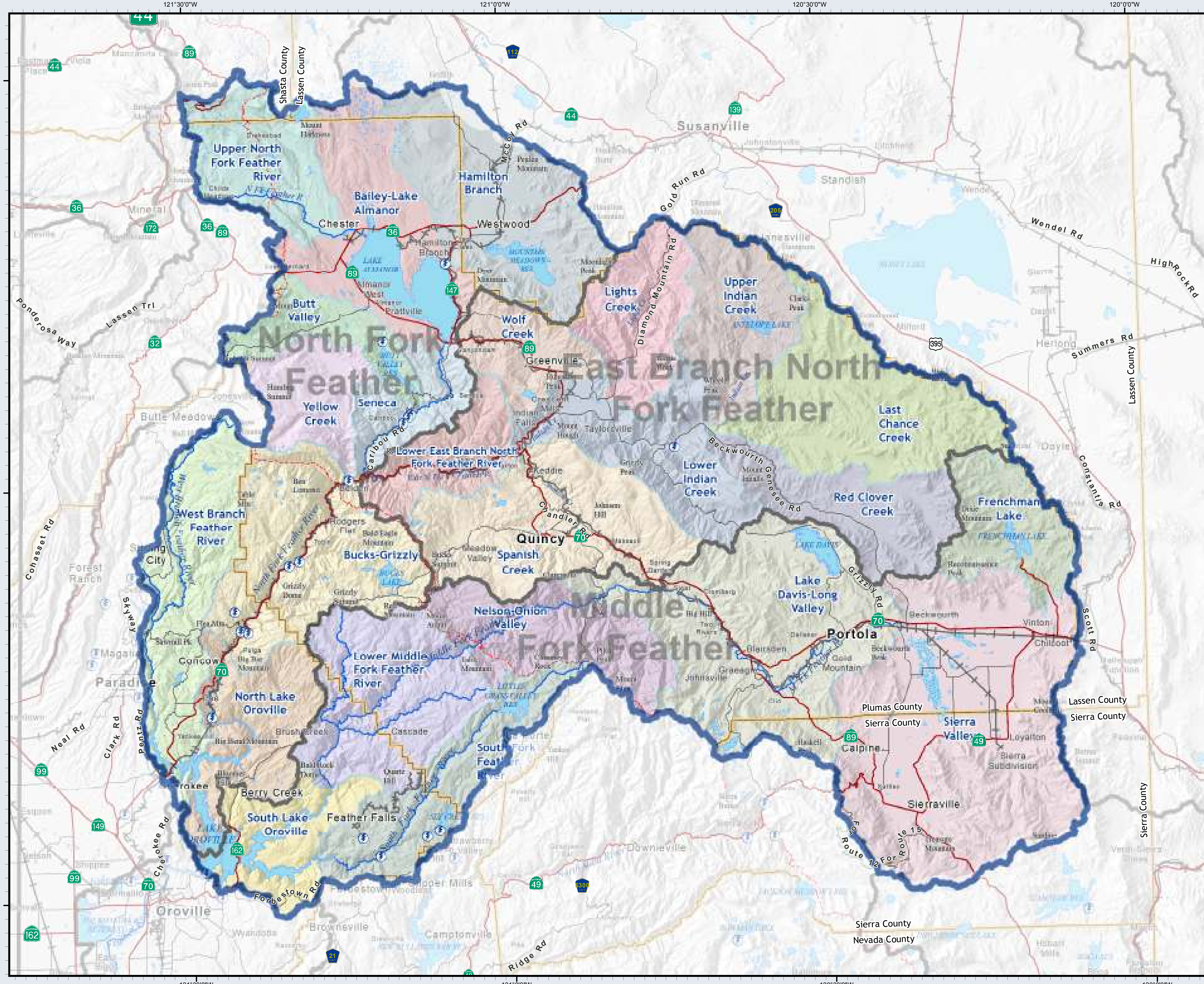
The Upper Feather River Watershed is divided into four main branches (Table 3-8): the West Branch, the North Fork, the Middle Fork, and the South Fork of the Feather River. The West Branch and South Fork are relatively small, comprising 8.1 percent of the watershed. The North Fork of the Feather River is the largest branch, draining 59.8 percent of the watershed. Its upper reaches are divided into two main branches: the Upper North Fork and the East Branch of the North Fork. The Middle Fork drains the remaining 32.1 percent of the watershed (ESF 2005, p. 4-12). The Upper Feather River watershed discharges approximately 3.8 million AF of water per year into Lake Oroville, based on average daily flows measured at gauging stations on the four main branches of the River over periods ranging as far back as the 1930s. These data are a rough approximation and do not necessarily reflect recent drought conditions. The Middle Fork contributes proportionally less water by area, due to it draining the comparatively dry Sierra Valley and the eastern slope of the Sierra Crest. The West Branch and South Fork contribute proportionally more water by area, because both of those watersheds are entirely on the comparatively wet west side of the Sierra Crest.

Table 3-8 Major Divisions of the Upper Feather River Watershed

Major Division	Area (ac.)	Percent of Watershed Area	Mean Daily Flow (cfs)[a]	Mean Daily Flow (gal. x 1,000)	Mean Annual Inflow to Lake Oroville (AF)	Percent of Annual Total
West Branch	106,102	4.6	350	226,210.9	253,388.8	6.6
North Fork	1,379,321	59.8	3,230	2,087,603.7	2,338,416.5	60.4
Middle Fork	740,405	32.1	1,500	969,475.4	1,085,951.9	28.1
South Fork	80,729	3.5	260	168,042.4	188,231.7	4.9
Total	2,306,557	100.0	5,340	3,451,332.4	3,865,988.9	100.0

[a] **Source: California Department of Water Resources. Mean daily flows are calculated for different periods in each division, based on availability of data.**

The Upper Feather River watershed comprises 23 subwatersheds, which are described below. The West Branch and South Fork each consists of a single subwatershed, as their watersheds are small and comparatively simple. The Middle Fork is divided into 6 subwatersheds, and the North Fork comprises the remaining 15 subwatersheds. Figure 3-6 depicts the subwatershed locations within the entire watershed (ESF 2005, p. 4-12).



Upper Feather River Integrated Regional Water Management Planning Area

Figure 3-6 Subwatersheds of the Upper Feather River

Subwatersheds

- Bailey-Lake Almanor
- Bucks-Grizzly
- Butt Valley
- Frenchman Lake
- Hamilton Branch
- Lake Davis-Long Valley
- Last Chance Creek
- Lights Creek
- Lower East Branch North Fork Feather River
- Lower Indian Creek
- Lower Middle Fork Feather River
- Nelson-Onion Valley
- North Lake Oroville
- Red Clover Creek
- Seneca
- Sierra Valley
- Smithneck Creek
- South Fork Feather River
- South Lake Oroville
- Spanish Creek
- Upper Indian Creek
- Upper North Fork Feather River
- West Branch Feather River
- Wolf Creek
- Yellow Creek

- Upper Feather River IRWM Planning Area
- Major Watersheds
- County
- Major Stream or River

0 2.5 5 10 15
Miles

Cartography by Deer Creek GIS
www.deercreekgis.com

3.5.1.1 Watershed Descriptions

Each of the 23 subwatersheds of the Upper Feather River watershed, along with its component stream reaches, lakes, dams, diversions, and reservoirs, is discussed below. The descriptions are organized by location within each of the four main forks: the West Branch, the North Fork, the Middle Fork, and the South Fork. The North and Middle Forks are generally described before their subwatersheds are discussed.

North Fork of the Feather River

The North Fork of the Feather River is the largest branch of the Upper Feather River. The large East Branch of the North Fork drains much of the east side of the Sierra Crest. Its headwaters flow from the Diamond Mountains in the north and east. Headwater streams originate in high alluvial valleys, while the lower reaches flow through steep canyons west of the Sierra Crest. There are several major dams along the North Fork that supply power and water for the large urban and agricultural developments to the south and west.

The North Fork of the Feather River is divided into two main branches, the main stem of the North Fork, and the East Branch of the North Fork. The main stem of the North Fork is divided into five subwatersheds above its confluence with the East Branch. The East Branch is divided into eight subwatersheds above the confluence. Two subwatersheds are below the confluence, and these two reaches, Bucks-Grizzly and North Lake Oroville, are the subject of Federal Energy Regulatory Commission (FERC) License Nos. 619, 1962, and 2100.

Middle Fork of the Feather River

The Middle Fork of the Feather River headwaters flows from the Frenchman area of the Diamond Mountains and the mountains surrounding Sierra Valley. The upper reaches lie in the large meadows of Sierra Valley, but after it flows through Mohawk Valley, the Middle Fork enters a wilderness canyon that is designated a Wild and Scenic River. The Middle Fork of the Feather River consists of two subwatersheds that contain broad valleys, Sierra Valley and Lake Davis-Long Valley.

West Branch Feather River Subwatershed

The headwaters of the West Branch of the Feather River are along the western side of the Sierra Crest. The West Branch flows southward through a steep canyon into the west side of Lake Oroville, which floods its bottom reach.

There are no major dams or impoundments on the West Branch; however, there are three small dams. The Round Valley Dam is on the West Branch of the Feather itself, while Philbrook and Concow dams are on tributaries bearing those names. The Philbrook Dam, built in 1877, is the oldest existing dam within the watershed.

Upper North Fork Feather River Subwatershed

The Upper North Fork of the Feather River subwatershed is in the extreme northwest portion of the Plan Area. The headwaters of the North Fork of the Feather River flow off the slopes of Mt. Lassen and Mt. Conrad, southwest of Lake Almanor. This section of the watershed receives high precipitation; over 90 inches per year near Lassen Peak. It has typical eastside stream characteristics, with streams flowing through alluvial valleys. The largest natural lake within the subwatershed is Juniper Lake in the northeast corner of the subwatershed, just north of Mt. Harkness.

The only major diversion within the subwatershed is the Chester Diversion on the North Fork just west of the town of Chester on the northwest shore of Lake Almanor. It diverts water south and west of the town of Chester and into Lake Almanor for emergency flood protection during large storm events and for big snowpack years.

Bailey-Lake Almanor Subwatershed

Located between the Upper North Fork of the Feather River and Hamilton Branch subwatersheds, the Bailey-Lake Almanor subwatershed includes the drainage area of Bailey Creek and the catchment of Lake Almanor itself. Lake Almanor receives water from two major diversions, the Chester Diversion in the Upper North Fork subwatershed and from Hamilton Branch diversion from the Hamilton Branch subwatershed. Lake Almanor was created in 1914 for hydropower production by the Western Power Company is now the largest hydroelectric reservoir and power generating facility for FERC No. 2105. In 1927, Lake Almanor Dam was constructed and increased the lake's capacity to 1.3 million AF. A tunnel connects Lake Almanor with Butt Lake to the southwest. Lake Almanor water levels, water quality, and recreation issues are managed by PG&E, under FERC No. 2105, and are affected by downstream requirements of PG&E's FERC No. 1962 and 2107 licenses (ESF 2005, 4-21).

Hamilton Branch Subwatershed

Bounded by the Diamond Mountains to the north, the Hamilton Branch subwatershed drains into Lake Almanor. In 1927, Indian Ole Dam was built along Hamilton Creek, creating Mountain Meadows Reservoir. The reservoir has a capacity of 24,800 AF, and is connected to Lake Almanor through a diversion canal. Mountain Meadows Reservoir is the only major water body within this subwatershed.

Butt Valley Subwatershed

Located southwest of the Lake Almanor subwatershed, the Butt Valley subwatershed flows southeast into the Seneca reach of the North Fork. The major stream is Butt Creek, which flows east from its headwaters along the eastern Sierra Crest and then south into Butt Valley Reservoir. Just before Butt Creek reaches the reservoir, a tunnel from Lake Almanor connects the two subwatersheds at a powerhouse on the northwest side of Butt Valley Reservoir. The reservoir covers 1,600 acres and has a capacity of 49,800 AF. PG&E manages Butt Valley Reservoir water levels, water quality, and recreation issues under its FERC License No. 2105.

Seneca Subwatershed

The Upper North Fork, Baily-Lake Almanor, Hamilton Branch, and Butt Valley subwatersheds flow into the Seneca subwatershed. The North Fork Feather River flows from the outlet below the Lake Almanor Dam south and west as it approaches the Sierra Crest. Just below the confluence of Butt Creek and North Fork Feather River, a tunnel connects Butt Valley Reservoir with the North Fork at Caribou Powerhouse. As the river flows southwest, the canyon becomes steeper and deeper, reaching over 3,000 feet deep at the bottom of this reach at the confluence with the East Branch North Fork.

PG&E operates a number of dams, diversions, penstocks, and powerhouses in this subwatershed; the operations of the facilities are regulated as part of the FERC No. 2105 license. Recreation management, reservoir operations, streamflow quantity and timing, stream habitat management, water quality in Lower Butt Creek and North Fork Feather River are dictated by FERC No. 2105 operations and include obligations for meeting specific downstream water flow and quality requirements and recreational flow conditions mandated in FERC No. 1962 and to a lesser extent for FERC No. 2107.

Yellow Creek Subwatershed

The Yellow Creek subwatershed includes Humbug Valley and consists of approximately 49,000 acres. The USFS, DFW, and CalTrout have collaborated with PG&E on resource management in the subwatershed for decades, particularly in the projection and restoration of Yellow Creek. Yellow Creek is a DFW-designated wild trout fishery that is protected by special fishing regulations (Stewardship Council 2007).

Bucks-Grizzly Subwatershed

The Bucks-Grizzly subwatershed is part of the North Fork Feather River Watershed, starting at the confluence of the East Branch North Fork Feather River and the North Fork Feather River, and extending downstream to the Poe Hydroelectric Project (FERC No. 2107) diversion dam on the North Fork Feather River. The Bucks-Grizzly subwatershed is bounded on the west by the West Branch Feather River subwatershed, and on the East by Spanish Creek subwatershed, Nelson-Onion Valley subwatershed, and Lower Middle Fork Feather River. State Highway 70 runs alongside the North Fork Feather River throughout this reach.

Bucks-Grizzly subwatershed includes numerous diversions and hydropower projects on the North Fork Feather River. Water is released from the Belden Powerhouse into Rock Creek Reservoir at the top of the reach. Water diverted at Rock Creek Dam enters a penstock and electricity is generated downstream where the water is again diverted at the Cresta Dam to produce electricity even farther downstream near the top of the Poe Hydroelectric Project. The Rock Creek and Cresta projects are collectively licensed by FERC No. 1962. Water temperature, timing and quantity of flow, sediment management, and recreation management are addressed in the FERC License No. 1962, which includes mandatory conditions by the State Water Resources Control Board and the Plumas National Forest through their statutory authority over these issues.

The Bucks-Grizzly subwatershed also includes numerous dams on tributaries to the North Fork Feather River. Spring Valley Lake, operated by CDFW, is a 75 AF reservoir behind an earthen dam located in the headwaters of Rock Creek at approximately 6,600 feet above sea level. PG&E under FERC license No.619 operates Lower Three Lakes Dam on Milk Ranch Creek. It has a capacity of 606 AF and is adjacent to Bucks Lake Wilderness. Bucks Diversion and Bucks Storage are located on Bucks Creek, the largest tributary to the North Fork Feather River in the Bucks-Grizzly subwatershed. Both are operated by PG&E, and together impound more than 100,000 AF of water. Grizzly Forebay is also operated by PG&E, and is located on Grizzly Creek.

Bucks Lake Wilderness is situated in the Bucks-Grizzly subwatershed and encompasses approximately 21,000 acres. The Pacific Crest National Scenic Trail bisects the subwatershed and the Bucks Lake Wilderness. Elevations within Bucks Lake Wilderness range from 2,000 feet in the North Fork Feather Canyon to more than 6,900 feet at Spanish Peak.

North Lake Oroville Subwatershed

The North Lake Oroville subwatershed includes the most-downstream reach of the North Fork Feather River, starting downstream of the Poe Hydropower Project (FERC No. 2107) diversion dam, and extending downstream to include North Lake Oroville and Oroville Dam (FERC No. 2100). The North Lake Oroville subwatershed is bounded on the west by the West Branch Feather River subwatershed and on the east by the Lower Middle Fork Feather River subwatershed and South Lake Oroville subwatershed. State Highway 70 runs adjacent to the North Fork Feather River from Lake Oroville to the northern extent of the reach. Poe Powerhouse utilizes water from nine miles of the North Fork Feather River to generate electricity during peak demand periods. Lake Madrone Water District operates one small reservoir of 200 AF on Berry Creek in the southern portion of the subwatershed near Lake Oroville.

Wolf Creek Subwatershed

The Wolf Creek subwatershed, located southeast of Lake Almanor, is a tributary to Lower Indian Creek. The subwatershed is separated from the Hamilton Branch subwatershed to the north by Keddie Ridge, which runs northwest to southeast. Wolf Creek, the main stream in the watershed, runs east along Highway 89 through the community of Greenville. The stream has been the focus of restoration efforts in the past. Wolf Creek is somewhat incised for much of the reach along the highway and through Greenville. Past Greenville, it flows out into Indian Valley, where it empties into Indian Creek. Bidwell Lake Dam on North Canyon Creek in the southern end of the watershed. Round Valley Reservoir, the only major impoundment within the subwatershed, is a dedicated water supply for the community of Greenville. There are also several irrigation diversions within the subwatershed. The Lower Wolf Creek watershed (25,748 acres), which begins just upstream of Greenville, has been identified by the Plumas National Forest as a priority watershed for restoration.

Lights Creek Subwatershed

The headwaters of Lights Creek flow south off of Diamond Mountain and make their way into the upper end of North Arm of Indian Valley before entering Indian Creek. There are no major lakes, reservoirs, dams or diversions within this subwatershed. There was mining along Lights Creek, and tailings can be found within the valley bottom sediments. There are also several irrigation diversions within the subwatershed.

Upper Indian Creek Subwatershed

The Upper Indian Creek subwatershed is located east of the Lights Creek subwatershed. The headwaters of Indian Creek flow off the south side of Diamond Mountain. Several small creeks that run off of the southwest side of the Diamond Mountains join the main stream in the Antelope Lake area. Antelope Lake reservoir is created by Antelope Lake Dam, a 22,566 AF capacity dam built in 1964. From the reservoir, Upper Indian Creek flows south into the head of Genesee Valley, just below the confluence of Last Chance Creek and Red Clover Creek. All of these waters come together to form Lower Indian Creek. The Upper Indian Creek subwatershed has been identified as a high priority watershed for restoration, with the main stem identified as a priority stream.

Last Chance Creek Subwatershed

This subwatershed drains the southwest slope of the Diamond Mountains from the Clarks Peak area in the north (adjacent to Upper Indian Creek), south to the Frenchman area. Last Chance Creek flows east to west along the Diamond Mountains. The Creek and its many small tributaries flow through a network of high meadow systems. Clarks Creek drains the north end of the subwatershed and then joins Last Chance Creek as the stream turns south toward Squaw Valley. Squaw Queen Creek flows east to west through the open meadows of Squaw Valley, roughly parallel to Last Chance Creek. Squaw Creek then flows into Last Chance Creek, and the waters flow west toward the confluence with Red Clover Creek and then Indian Creek. There are no major impoundments, lakes, or other large water bodies in this subwatershed. Meadow restoration projects have been implemented in the subwatershed.

Red Clover Creek Subwatershed

The Red Clover Creek subwatershed is a narrow catchment flowing from the Frenchman area at the edge of Sierra Valley. It runs west-northwest between Lake Davis and Squaw Queen Creek. Dixie Creek drains off of Dixie Mountain into a meadow system nearly connected to Squaw Valley; it then flows into Red Clover Creek in the larger Red Clover Valley. Red Clover Valley is a large open valley separated from Lake Davis by Crocker Mountain. Meadow restoration projects have been implemented in the subwatershed.

The waters of Red Clover Creek then flow west to the confluence with Last Chance Creek, and then into Lower Indian Creek. There are no major water bodies or substantial water infrastructure facilities within this subwatershed.

Lower Indian Creek Subwatershed

Lower Indian Creek begins when Last Chance and Red Clover Creeks, after coming together upon entering Genesee Valley, flow into Upper Indian Creek. The Creek flows west through Genesee Valley in a broad incised channel. Ward Creek, a tributary to Indian Creek, has a hydroelectric power plant on it. Two main tributaries enter at the bottom of Genesee Valley: Hosselkus Creek from the Kettle Rock-Eisenhower area to the north, and Little Grizzly Creek from the Lake Davis area to the south. Dolly Creek, a tributary to Little Grizzly Creek, was the site of Walker Mine. The USFS manages a small concrete dam at the Walker Mine tailings site that serves to maintain the historic impoundment of the tailings.

After Hosselkus Creek and Little Grizzly Creek enter Indian Creek, Indian Creek leaves Genesee Valley and passes through a narrower valley between Mt. Jura and Grizzly Peak toward the community of Taylorsville and Indian Valley. Lights Creek enters into Indian Creek out of the North Arm of Indian Valley. At the west side of the valley, Wolf Creek enters just after flowing through Greenville. Indian Creek then flows south to its confluence with Spanish Creek to form the East Branch of the North Fork. There are no major waterbodies or substantial water infrastructure facilities in this subwatershed. There are several irrigation diversions within the subwatershed. Additionally, groundwater is pumped for irrigaton and domestic uses.

Spanish Creek Subwatershed

This subwatershed is centrally located within the Upper Feather River Watershed. Spanish Creek's headwaters are high on the eastern side of the Sierra Crest in the Spanish Peak area above Bucks Lake. There are two impoundments built on Silver Creek and Wapaunsie Creek, which are tributaries of Spanish Creek. Spanish Creek and its tributaries flow east from the Sierra Crest, through Meadow Valley, into the western end of American Valley, and past the town of Quincy. From the eastern part of the subwatershed, Greenhorn and Thompson Creeks flow west down the Plumas Trench into Thompson Valley, and then into Spanish Creek at the eastern end of American Valley. The Tollgate Creek-Spanish Creek watershed (22,850 acres), which begins immediately downstream of the confluence of Spanish and Greenhorn Creeks, has been identified by the Plumas National Forest as a priority watershed for restoration.

Because the headwaters of Spanish Creek flow from high Sierra peaks, the western part of the subwatershed receives uncharacteristically high precipitation for the East Branch of the North Fork. It, therefore, has a large discharge compared to other subwatersheds of the East Branch.

Lower East Branch of the North Fork of the Feather River Subwatershed

The confluence of Spanish Creek and Lower Indian Creek form the East Branch of the North Fork of the Feather River. The river runs roughly east to west through the Feather River canyon. As the river approaches the Sierra Crest to the west, the river enters the approximately 1,000-yard Serpentine Canyon along a railroad grade and Highway 70. The East Branch of the North Fork of the Feather River meets the North Fork at the end of the canyon at French Bar, the western end of the subwatershed.

Frenchman Lake Subwatershed

This small subwatershed is located north of Sierra Valley, from the Diamond Mountains in the east to Dixie Mountain in the west. Little Last Chance Creek flows southeast from the divide with Last Chance Creek into Frenchman Lake, a 1,500-acre reservoir in Little Last Chance Valley. Frenchman Lake, at 55,000 AF, is managed primarily for irrigation and recreation.

Sierra Valley Subwatershed

Sierra Valley is the largest valley in the IRWM Plan Area. The valley is a broad expanse of meadows crossed by a network of stream channels. Although there is only one small dam within the subwatershed (on Antelope Creek), there is a network of irrigation canals throughout the valley. Sierra Valley is an ancient lake basin, and contains several seasonal and perennial standing water bodies. The many stream channels, along with Little Last Chance Creek (from the Frenchman area), come together to form the Middle Fork of the Feather River in the northwest corner of the valley.

Lake Davis-Long Valley Subwatershed

The Middle Fork flows northwest out of Sierra Valley then northeast toward the Sierra Crest and the Nelson-Onion Valley subwatershed. In the northern part of the subwatershed, Big Grizzly Creek flows off of Grizzly Peak through Grizzly Valley and empties into Lake Davis, an 83,000-AF capacity reservoir. Below Lake Davis, there is a small private dam on Big Grizzly Creek before it flows into the Middle Fork. The Big Grizzly Creek watershed (33,438 acres) has been identified by the Plumas National Forest as a priority watershed for restoration.

Downstream of Big Grizzly Creek, the Middle Fork flows through the town of Portola and Humbug Valley. The river enters the Mohawk Valley and the community of Graeagle as it turns northwest to parallel the Sierra Crest. Above the Mohawk Valley to the southwest, four small dams exist up in the high lakes area. Several natural lakes exist in the vicinity, including the largest, Gold Lake. The Frazier Creek watershed (33,772 acres), which includes Gold Lake and the community of Graeagle, has been identified by the Plumas National Forest as a priority watershed for restoration. After following Mohawk valley northwest the river turns west and begins to cut through the high Sierra. This is the beginning of the Middle Fork Canyon, which is the Wild and Scenic portion of the Middle Fork, exceeding 3,000 feet from ridge to river in some places.

Nelson-Onion Valley Subwatershed

The Middle Fork flows west out of the Lake Davis-Long Valley subwatershed to be joined by Nelson Creek at the east end of the Nelson-Onion Valley subwatershed. Nelson Creek drains a basin between the north slope of the Sierra Crest and Eureka Ridge. After gaining the substantial flow of Nelson Creek, the Middle Fork enters the Middle Fork Canyon. There are no major waterbodies or substantial water infrastructure facilities in the subwatershed. Both the Nelson Creek watershed (29,119 acres) and the Washington Creek watershed (12,635 acres), which includes the stretch of Middle Fork immediately downstream of the Nelson Creek confluence, have been identified by the Plumas National Forest as a priority watersheds for restoration.

Lower Middle Fork Subwatershed

The Middle Fork flows from the northeast to southwest through the canyon as west-side tributaries such as the Little North Fork and South Branch of the Middle Fork add to its flow. It then empties into Lake Oroville just below Bald Rock Canyon in Feather Falls National Scenic Area. There are no major waterbodies or substantial water infrastructure facilities in the subwatershed. The Little North Fork of Middle Fork Feather watershed (29,627 acres) includes the streams in the northwest quarter of the subwatershed and has been identified by the Plumas National Forest as a priority watershed for restoration.

South Lake Oroville Subwatershed

This small subwatershed encompasses the uplands surrounding the arm of Lake Oroville that floods the bottoms of the Middle Fork and South Fork canyons. Lake Oroville is the largest water body within the entire watershed, with a 3.5 million AF capacity. Its 15,805-acre surface spans the South Lake Oroville and North Lake Oroville subwatersheds.

South Fork of Feather River Subwatershed

Like the West Branch, the South Fork contains only one subwatershed. The South Fork subwatershed is a roughly linear northeast to southwest drainage off the western slope of the Sierra Nevada.

This small sub-watershed contains seven dams. The largest reservoir is Little Grass Valley Reservoir on the main stem of the South Fork. At 93,010 AF of capacity, Little Grass Valley is the fourth largest water body within the Upper Feather River Watershed. This reservoir is just west of Gibsonville Ridge, the southern edge of the Upper Feather River Watershed. Downstream of the South Fork Diversion (owned by the South Feather Water and Power), the river passes between Lumpkin and Mooreville Ridge. Lost Creek drains the area east of Mooreville Ridge before entering at the deeper, 1,200 foot canyon south of Fields Ridge. Lost Creek passes through several reservoirs before entering the South Fork. The largest, Sly Creek, has over 65,000 AF of capacity. There is another small dam on Grizzly Creek, a small tributary to the south. After passing through Forbstown Diversion (owned by the South Feather Water and Power), the South Fork spills into Ponderosa Reservoir, at the top of the southernmost arm of Lake Oroville.

3.5.1.2 Groundwater Basins

The water resources of the Upper Feather River watershed consist of surface waters (streams, rivers, lakes and reservoirs) as well as subsurface waters. The majority of the subsurface water resources of the Upper Feather River watershed are contained in groundwater basins. 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. A groundwater basin is three-dimensional and includes both the surface extent and also all of the subsurface fresh water-yielding materials.

Due to the steep V-shaped canyons of the western slopes of the Sierra Nevada, there are no large groundwater basins west of the Sierra Crest. Near Lake Oroville, the Sacramento Valley Eastside Groundwater Basin marks the edge of the underground storage reservoirs contained under the Sacramento Valley. The alluvial valleys of the eastside subwatersheds allow water to percolate into subsurface reservoirs. The watershed of the North Fork contains most of the groundwater basins in the region; however, the largest groundwater basin in the Plan Area, the Sierra Valley Groundwater Basin, is in the watershed of the Middle Fork.

The DWR identifies 14 groundwater basins in the Plan Area (Figure 3-7) (DWR 2003a):

- 5-7 Lake Almanor Valley
- 5-8 Mountain Meadows Valley
- 5-9 Indian Valley
- 5-57 Last Chance Creek Valley
- 5-58 Clover Valley
- 5-59 Grizzly Valley

- 5-10 American Valley
- 5-11 Mohawk Valley
- 5-12 Sierra Valley (2 sub-basins)
- 5-56 Yellow Creek Valley
- 5-60 Humbug Valley
- 5-87 Middle Fork
- 5-95 Meadow Valley
- Modoc Plateau Pleistocene Volcanic Area (not described)

Lake Almanor Valley Groundwater Basin

The Lake Almanor Valley Groundwater Basin covers 7,150 acres along the northwest shore of Lake Almanor. The basin is bounded by Lake Almanor to the southeast and on all other sides by Pliocene basalt. The basin consists of Quaternary lake deposits and Pleistocene non-marine sediments.

In 1960, the DWR estimated the storage capacity to be 45,000 AF for a saturated depth interval of 10 to 210 feet. There are no known groundwater management plans, groundwater ordinances, or basin adjudications associated with this groundwater basin. In 2014, DWR ranked the basin as an overall basin priority of very low, based on overdraft and water quality impairments (DWR 2014c). However, the Maidu People would like to revist the management plan and the ranking decision previously made.

Mountain Meadows Valley Groundwater Basin

The 8,145-acre Mountain Meadows Valley Groundwater Basin is located to the northeast of Lake Almanor. The basin consists of Quaternary alluvium which encircles Mountain Meadows reservoir. The basin is bounded to the northeast by Jurassic to Triassic metavolcanic rocks and Tertiary non-marine sediments. The basin is bounded to the southeast by Miocene volcanic rocks and to the northwest by Pleistocene basalt. There are no known groundwater management plans, groundwater ordinances, basin adjudications, or monitoring programs in place. In 2014, DWR ranked the basin as an overall basin priority of very low (DWR 2014d).

Meadow Valley Groundwater Basin

This 5,730-acre groundwater basin lies within the Melones Fault Zone of the Sierra Nevada. The basin is bounded on the west by the Mesozoic ultrabasic rocks, to the north by Pliocene pyroclastic rocks, and to the east by ultrabasic intrusive rocks and Paleozoic marine sediments. There is no information on groundwater storage or quality for this basin. In addition, there are no known groundwater management plans, groundwater ordinances, or basin adjudications. In 2014, DWR ranked the basin as an overall basin priority of very low based on overdraft and water quality impairments (DWR 2014e). As in Lake Almanor Valley Groundwater Basin above, the Maidu People would like to revist the management plan and the ranking decision previously made for the Meadow Valley Groundwater Basin.

Indian Valley Groundwater Basin

This 29,410-acre groundwater basin is an irregularly shaped basin bounded by Paleozoic to Mesozoic marine, volcanic, and metavolcanic rocks. This basin includes Genesee Valley, Indian Valley, and Bucks Valley. In 1960, the DWR estimated the storage capacity to be 100,000 AF for a saturated depth interval of 10-210 feet. There is no information about water quality for this basin. In addition, there are no known groundwater management plans, groundwater ordinances, or basin adjudications. In 2014, DWR ranked the basin as an overall basin priority of very low (DWR 2014f).

Upper Feather River Integrated Regional Water Management Planning Area

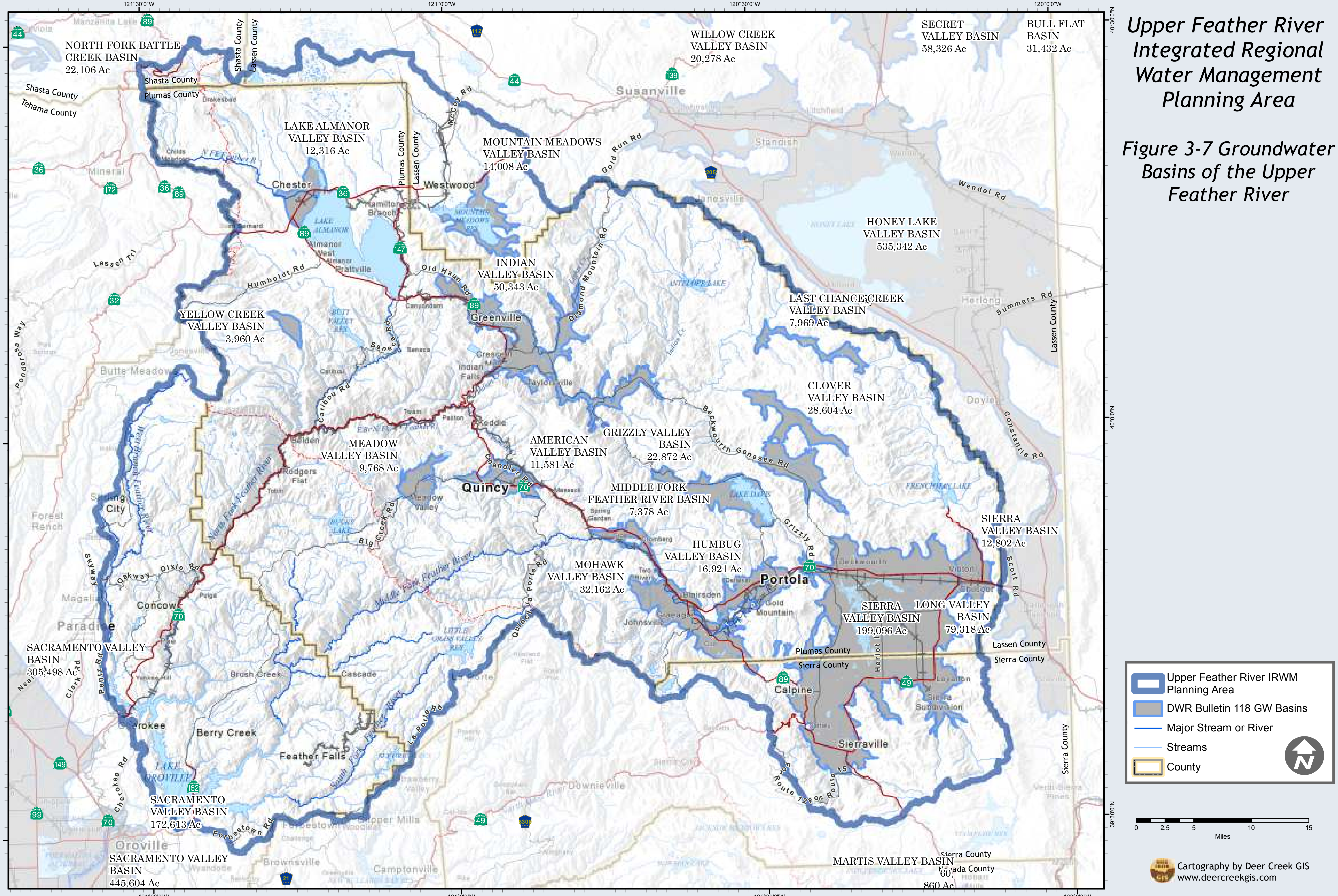


Figure 3-7 Groundwater Basins of the Upper Feather River

Middle Fork of the Feather River Groundwater Basin

The Middle Fork of the Feather River Groundwater basin encompasses 4,340 acres and consists primarily of Quaternary lake and alluvial deposits. This region is dominated by northwest trending faults. One of these faults forms the basin boundary to the east, while the northern and southern boundaries are formed by Pliocene and Miocene volcanic rocks. The eastern boundary is formed by Paleozoic marine deposits. There are no known groundwater management plans, groundwater ordinances, or basin adjudications. In 2014, DWR ranked the basin as an overall basin priority of very low (DWR 2014g).

Humbug Valley Groundwater Basin

This 9,980-acre basin is situated in the Penman Peak-Beckwourth Peak area northeast of Mohawk Valley. Humbug Valley is approximately six miles long by three miles wide, and is bounded to the north by the volcanic rocks of Penman Peak, to the southeast by Miocene volcanic rocks of Beckwourth Peak, and to the northeast by Mesozoic granitic rocks. The floor of the canyon is composed mainly of level alluvium and gently sloping lake deposits at the western end of the valley. In 1963 the DWR estimated the storage capacity to be 76,000 AF to a depth of 100 feet (DWR 1963). There are no known groundwater management plans, groundwater ordinances, or basin adjudications. In 2014, DWR ranked the basin as an overall basin priority of very low (DWR 2014h).

Grizzly Valley Groundwater Basin

The Grizzly Valley Groundwater Basin lies within a graben bounded to the northeast by Grizzly Valley Fault and to the southwest by a series of northwest trending faults. The 13,440-acre basin is bounded to the north by Miocene volcanic rocks and to the south by Paleozoic marine sediments, Mesozoic granitic rocks, recent volcanics, and Tertiary intrusive rocks. Grizzly Creek drains the valley and is a tributary to the Middle Fork Feather River. There are no known groundwater management plans, groundwater ordinances, or basin adjudications. In 2014, DWR ranked the basin with an overall basin priority of very low (DWR 2014i).

Clover Valley Groundwater Basin

The Clover Valley Groundwater Basin is an irregularly shaped basin of 16,780 acres that includes McReynolds Valley, Squaw Valley, Clover Valley, and Wakeynolds Valley. These valleys consist of alluvium deposits and lake sediments. The basin is bounded by Miocene volcanic rocks on the north, east, and south and by recent volcanic and Mesozoic granitic rocks to the west. Dixie Creek and Red Clover Creek drain the southern two thirds of the basin to the west, and Squaw Queen Creek drains the northern third of the basin to the northeast. There are no known groundwater management plans, groundwater ordinances, or basin adjudications. In 2014, DWR ranked the basin with an overall basin priority of very low (DWR 2014j).

Last Chance Creek Valley Groundwater Basin

The Last Chance Creek Groundwater Basin is a narrow, east/west trending basin located at the southwestern foot of the Diamond Mountains and covers 4,660 acres. The basin is bounded to the south by Tertiary pyroclastic rocks and to the north by Miocene volcanics, Mesozoic granitic rocks, and Tertiary pyroclastic rocks. Eocene basalt borders the basin in the west. There are no known groundwater management plans, groundwater ordinances, or basin adjudications. In 2014, DWR ranked the basin with an overall basin priority of very low (DWR 2014k).

Yellow Creek Valley Groundwater Basin

The Yellow Creek Groundwater Basin is a 2,310-acre basin located to the southwest of Lake Almanor and consists of Quaternary alluvium. The valley is drained to the south by Yellow Creek. The valley is bounded to the east by Mesozoic and Paleozoic marine sediments, to the north and west by Tertiary volcanic rocks, and to the south by recent volcanic and Paleozoic marine sediments. There are no known groundwater management plans, groundwater ordinances, or basin adjudications. In 2014, DWR ranked the basin with an overall basin priority of very low (DWR 2014l).

Sierra Valley Sub-Basin

The 117,380 acre Sierra Valley Sub-basin covers the majority of the Sierra Valley Groundwater Basin. Sierra Valley is an irregularly shaped, complexly faulted valley in eastern Plumas and Sierra counties. The basin is bounded to the north by Miocene pyroclastic rocks of Reconnaissance Peak, to the west by Miocene andesite of Beckwourth Peak, to the south and east by Tertiary andesite, and to the east by Mesozoic granitic rocks. The primary water-bearing formations in Sierra Valley are Holocene sedimentary deposits, Pleistocene lake deposits, and Pleistocene lava flows.

The aquifers of the valley are mainly alluvial fan and lake deposits. The alluvial fans grade laterally from the basin boundaries into course lake and stream deposits. The deposits of silt and clay act as aquitards or aquicludes in the formation. Aquiclude materials are predominantly fine-grained lake deposits. In the central part of the basin, alluvial, lake, and basin deposits compose the upper 30 to 200 feet of aquitard material that overlies a thick sequence of interstratified aquifers and aquicludes.

Most of the upland recharge areas are composed of permeable materials occurring along the upper portions of the alluvial fans that border the valley. Recharge to groundwater is primarily by way of infiltration of surface water from the streams that drain the mountains and flow across the fans. Increases in groundwater development in the mid to late 1970s resulted in the cessation of flow in many artesian wells. Large pumping depressions formed over the areas where heavy pumping occurred. Water levels in a flowing artesian well in the northeast portion of the basin declined to more than 50 feet below ground surface by the early 1990s. While Subsequent reductions in groundwater pumping through the 1990s helped to recover groundwater levels to mid-1970's levels, increased pumping in more recent years has dropped water levels in some monitored wells to the deepest level on record (Sierra Valley GMD 2015).

The estimated groundwater storage in the Sierra Valley Basin is 7,500,000 AF to a depth of 1,000 feet. In 1963 the DWR noted that the quantity of useable water as being unknown. In 1973, the DWR estimated storage capacity to be between 1 million to 1.8 million AF for the top 200 feet of sediment based on an estimated specific yield ranging from 5 to 8 percent. These estimates include the Chilcoot Sub-basin. A wide range of mineral type waters exist throughout the Sierra Valley Basin. Sodium chloride and sodium bicarbonate type waters occur south of Highway 49 and north and west of Loyalton along fault lines. Two wells contain waters that are sodium sulfate in character. In other parts of the Sierra Valley, the water is bicarbonate with mixed cationic character. Calcium bicarbonate type water is found around the rim of the basin and originates from surface water runoff.

The poorest quality groundwater is found in the central west side of the valley where fault-associated thermal waters and hot springs yield water with high concentrations of boron, fluoride, iron, and sodium. Several wells in this area also have high arsenic and manganese concentrations. Boron concentrations in thermal waters have been measured in excess of 8 mg/L. At the Basin fringes, boron concentrations are usually less than 0.3 mg/L. There is also a sodium hazard associated with thermal waters in the central portion of the basin.

The Sierra Valley Groundwater Management District, an entity created by the Sierra Valley Groundwater Management District legislation, manages the Sierra Valley Basin. This legislation clearly defined the boundaries over which the district has authority to manage the groundwater resources. The Chilcoot Sub-basin (described below) falls within the boundaries of the Sierra Valley Groundwater District.

In 2014, DWR ranked the Sierra Valley Groundwater Basin with an overall basin priority of medium (DWR 2014m). This is the only groundwater basin in the Plan Area that is elevated above "very low priority." An extensive modeling effort is currently underway in the basin to better equip overlying landowners with assessment tools for managing this large and complex basin through increasingly variable precipitation cycles.

Chilcoot Sub-Basin

The Chilcoot Sub-basin is an irregularly shaped, 7,550-acre, complexly faulted valley on the eastern side of the Sierra Valley Groundwater Basin in Plumas County. The basin is bounded to the north and east by Mesozoic granitic rocks, and to the south by Tertiary Sierran basalt and pyroclastic rocks and Paleozoic metamorphic rocks. The basin is hydrologically connected to the Sierra Valley Basin to the west in the near surface but may be discontinuous at depth due to a bedrock sill. The primary water-bearing formations in the Chilcoot Sub-basin are Holocene sedimentary deposits and silt and sand deposits, fractured and faulted Paleozoic to Mesozoic metamorphic and granitic rocks, and Tertiary volcanic rocks. As noted, the Sierra Valley Groundwater District manages the Chilcoot Sub-basin. In 2014, DWR ranked the sub-basin with an overall basin priority of very low (DWR 2014n).

Mohawk Valley Groundwater Basin

The Mohawk Valley Groundwater Basin encompasses 18,990 acres and lies within an elongated valley occupying a portion of the Plumas Trench. The basin is bounded on the southwest side by the Mohawk Valley Fault and on the east side by a group of northwest trending faults that branch from the Mohawk Valley fault near Sattley. The floor of the valley consists of a narrow strip of nearly flat alluvial material overlying lake sediments. Lake sediments also underlie the upland areas of the valley. Depth to bedrock is estimated to range between 1,500 and 3,000 feet. The basin is bounded to the northeast by Pliocene volcanic rocks of Penman Peak, to the east by Miocene volcanic rocks of Beckwourth Peak, and to the west and southwest by Paleozoic metavolcanic rocks and Mesozoic granitic rocks of the Sierra Nevada. Sulphur Creek drains the southern half of the valley and enters the Middle Fork of the Feather River near the midpoint of the valley and flows northwesterly. Storage capacity for the Mohawk Valley basin is estimated to be 90,000 AF based on a specific yield of 5 percent for a depth interval of zero to 200 feet. Calcium-magnesium bicarbonate and sodium bicarbonate are the predominant groundwater types in the basin. There is a groundwater management plan for the Plumas-Eureka Community Services District. There are no other known groundwater management plans, groundwater ordinances, or basin adjudications associated with this basin. In 2014, DWR ranked the basin with an overall basin priority of very low (DWR 2014o).

American Valley Groundwater Basin

The American Valley Groundwater Basin is a 6,800-acre basin bounded to the southwest and northeast by a northwest trending fault system. The basin is bounded to the northeast by Paleozoic metavolcanic rocks and on all other sides by Paleozoic marine sedimentary and meta-sedimentary rocks of the Sierra Nevada. Spanish Creek drains the valley and is a tributary to the North Fork Feather River to the northwest. In 1960, the DWR estimated storage capacity to be 50,000 AF for a saturated depth interval of 10 to 210 feet. No groundwater management plans, groundwater ordinances, or basin adjudications are associated with this basin. In 2014, DWR ranked the basin with an overall basin priority of very low (DWR 2014p).

3.5.2 Hydrology and Surface Water Resources

The Upper Feather River drains from its headwaters in the Sierra Nevada, Cascades, and Diamond Mountains into Lake Oroville, which is the largest water storage facility in the State .Water Project system. Lake Oroville has a water storage capacity of 4 million AF and generates an average of 3.2 million AF of "firm" annual water supplies to both agricultural and urban State Water Contractors, largely through export pumping from the Sacramento-San Joaquin Delta. The total estimated mean annual discharge into Lake Oroville is 3.8 million AF, based on long-term historical stream flow data. Current inputs to Lake Oroville are likely less than that, given the recent drought. Water output from the Plan Area above the 3.2 million AF "firm" supplies to State Water Contractors, if any, is discharged to the Pacific Ocean through San Francisco Bay.

The North Fork of the Feather River powers PG&E's 734 MW Stairway of Power, a complex of ten interconnected hydroelectric powerhouses; eight dams; and extensive networks of tunnels bored through canyon bedrock that collect tributary streamflows and connect upland storage reservoirs to the main stem of the river in the Feather River Canyon. The Middle Fork of the Feather River originates in the Sierra Valley–the largest valley both in the watershed and in the Sierra Nevada–and descends into the Middle Fork Canyon, 78 miles of which are designated Wild and Scenic River, before flowing into Lake Oroville.

The Upper Feather River watershed has been historically shaped and currently affected by state and federal land and water policies, uses, and conflicts. A large proportion of land is owned by the federal government and the history of large-scale water supply and hydroelectric developments is extensive. The sparse population of the headwaters region has been engaged in ongoing collaborative and conflictive relationships with downstream regions of California, an engagement that belies its physical isolation from the heavily populated regions of Southern California and the Bay Area, and the highly contentious San Francisco Bay Delta. Current hydroelectric operations are regulated by the FERC, and future operations of both PG&E's and DWR's hydroelectric dams and diversions are in various stages of review in six discrete but interrelated relicensing proceedings before the FERC: FERC No. 2100, FERC No. 2107, FERC No. 2105, FERC No. 1962, FERC No. 619, and FERC No. 803.

Two basins in the UFR watershed have water rights decrees, established in the Superior Court of California: the 1940 Sierra Valley Decree (No. 3095), the 1959 Little Last Chance Creek Decree (DWR 1959), and the 1950 Indian Creek Decree (No. 4185) (DWR 2004b). The decrees identify specific beneficiaries and water rights, which remain superior in seniority to pre-1914 water rights. DWR provides water masters for the Sierra Valley and Indian Creek areas to ensure that the water is allocated according to established water rights and to "prevent the waste or unreasonable use of water (Regents 2007).

3.5.3 Groundwater Resources

The DWR has estimated storage capacity for only five of the 14 groundwater basins in the Plan Area. The total estimated groundwater storage capacity in those five basins is 7.8 million AF, of which 7.5 million AF is estimated to be in Sierra Valley. If groundwater reserves in the Plan Area are in equilibrium, estimated groundwater reserves are at least two times the annual surface water discharge from the Plan Area. However, estimated storage capacity in groundwater basins may substantially exceed the amount of groundwater that is realistically available for (1) artificial extraction by pumping or (2) natural processes of surface water recharge. Because many of the groundwater basins in the Plan Area are located in ancient lakes and structural basins that have been largely filled with sediment, aquifers are 1,000 or more feet deep in some basins (see discussions of Sierra Valley and Mohawk Valley Groundwater Basins, above). Deep groundwater may be confined to those basins, and unavailable for either natural or artificial recharge of surface water through springs, seeps, or pumping. Groundwater pumping in Sierra Valley has markedly depleted artesian wells and artificial wells beginning in the 1970s, despite the large estimated storage capacity of the basin.

3.5.4 Runoff Generation and Water Balance

Virtually all of the water in the IRWM Plan Area arrives in the form of precipitation. The two exceptions are a diversion from the Little Truckee River that provides water to parts of Sierra Valley, and water that is delivered to the region in bottled form (Plumas Co. 2009, p. 30). Precipitation is highest on the western side of the Sierra Crest and the southern slopes of Mount Lassen, and lowest in the eastern portion of Sierra Valley. Precipitation generally increases with elevation everywhere in the Plan Area. Because of the Mediterranean climate, most of the precipitation in the Plan Area comes during the winter in the form of snow at higher elevations. In this lowest elevation region of the Sierra Nevada Mountain range, snowpack and extensive groundwater storage play an important role in shaping the hydrograph of nearby and more distant streams and rivers. For example, mountain meadows, a widely distributed feature in this region compared to most of the rest of the Sierra Nevada, are places where groundwater surfaces, and then connects with local streamflows. Meadows are places where flood flows are slowed and captured during winter and spring, and gradually released as surface and subsurface flows downstream during the summer and fall in combinations of surface and groundwater flows that are specific to the soils and geology of each meadow. Restored meadows provide increased forage for wildlife and livestock, increased diversity and vigor of native plants, expanded and improved habitat connectivity for fish and wildlife, increased carbon sequestration (50 tons/acre). In some meadows, summer stream temperatures are reduced and riparian vegetation is more resilient during periods of drought. The continuity of culturally important tribal practices and recreational amenities are other benefits of restored meadows (Plumas Co. 2009, p. 27). Meadows, springs, fens, bogs, riparian forests, wetlands and marshes, although a small proportion of the landscape, are biologic and cultural "hot spots."

3.5.4.1 Streamflow Averages and Extremes

Streamflow averages in the region have undergone a steady decline since the mid-1960s (Chapter 8 *Climate Change*, Figure 8-3). Runoff within the region is affected by cumulative annual reductions in snowpack accumulation and melt, and by rising temperatures. The prolonged dry period of the last ten years has significantly reduced flow from springs and groundwater discharge to streams that provide summer and fall stream flows.

Mountain meadow, headwaters of the North Fork Feather River, and Lassen Peak (Source: Wikipedia)

With the concern over climate change, more variable precipitation patterns, more extreme drought and flood events, and increasing reduction in snowpack in the coming decades (Chapter 8 *Climate Change*), the restoration of groundwater and surface hydrology is pertinent and increasingly important. Restoration can be enhanced by stabilizing erosion in mountain meadows and in alluvial valleys, and by reversing the densification of uplands forests. For example, re-watering degraded meadows and floodplains has been identified as an important flood peak attenuation, water storage, and recharge adaptation to a changing precipitation regime. A 2008 study by Jones and Stokes concluded that there was in excess of 500,000 AF of "available" groundwater storage volume in de-watered meadows in the region, and that additional water storage in excess of 100,000 AF could be restored for enhanced groundwater recharge. The effect of enhanced groundwater storage on specific stream reaches is determined by soils and geology and varies with different precipitation patterns. The USGS has estimated that up to 40 percent of the annual surface flows into Lake Oroville originate from groundwater storage in the UFR watershed. In dry years, groundwater inputs to surface flows are significantly higher and groundwater sustains dry season streamflows as described in a Forest-Water Balance study (Appendix 3-2) developed as part of the Plan (Bohm 2016).

3.5.5 Droughts and Floods

California's Mediterranean climate is marked by recurring droughts and historic floods, including the extended 1928-1934 drought, as well as the historic peak floods that existed as of the 1940s, 1950s and 1960s. We continue to see new records broken for both drought and flood events.

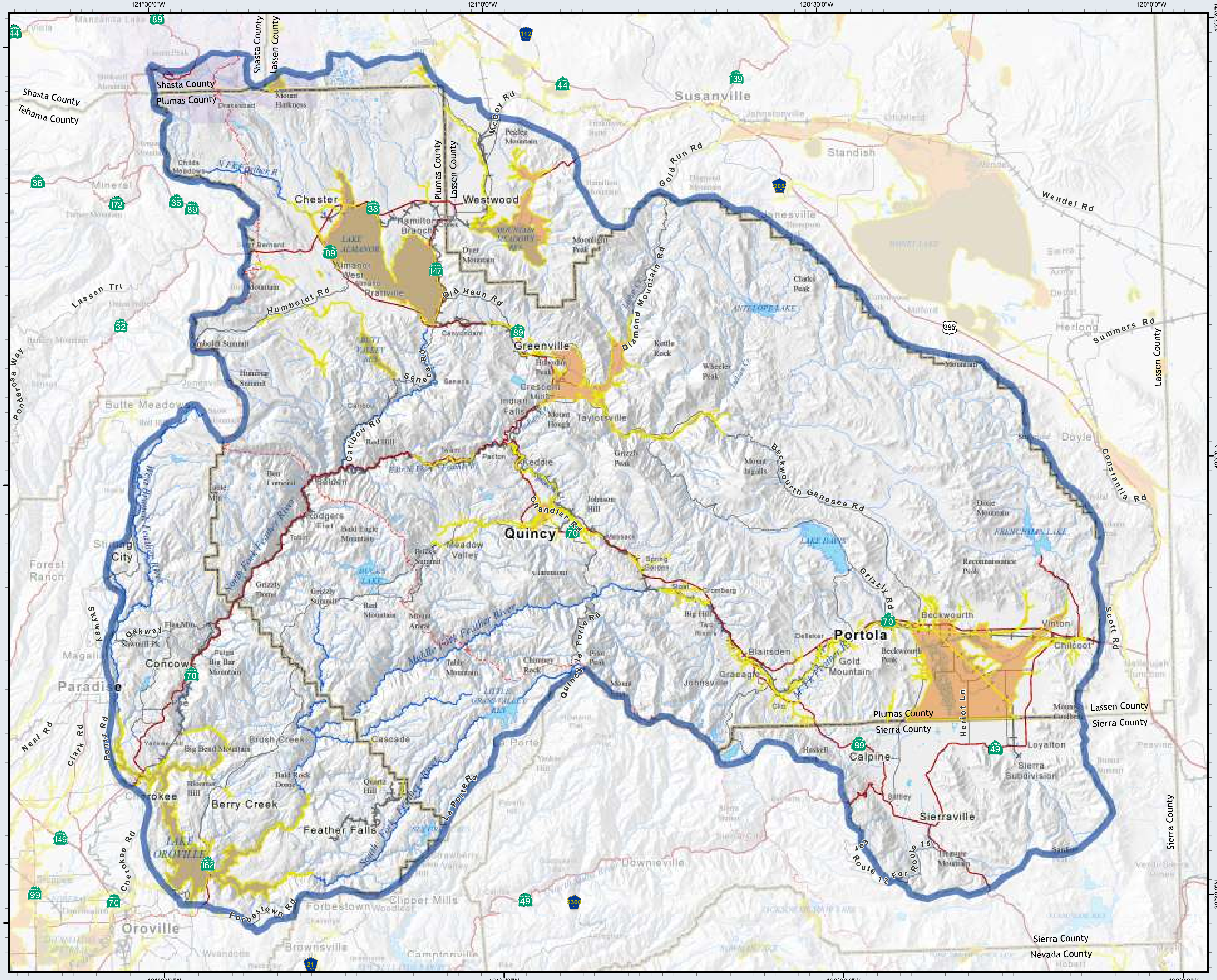
3.5.5.1 Droughts

California’s most significant historical statewide droughts were the six-year drought of 1929-34, the two-year drought of 1976-77, and the six-year event of 1987-92. These droughts stand out in the observed record due to their duration or severe hydrology. For example, the 1976-77 drought was short but very severe (1977 is still the driest year in recorded history in the state) and the 1987–94 drought was extreme in its unprecedented duration. More recently, the 2007-2009 drought was the first drought for which a statewide proclamation of emergency was issued – a proclamation that was again issued for the 2012-2015 drought. The water years of 2012-2014 stand as California’s driest three consecutive years in terms of statewide precipitation (DWR 2014).

The 2012-2015 drought event set other records in addition to that of driest three-year period of statewide precipitation. The drought occurred at a time of record warmth in California, with new climate records set in 2014 for statewide average temperatures. Records for minimum annual precipitation were set in many communities in calendar year 2013. Calendar year 2014 saw record-low water allocations for State Water Project and federal Central Valley Project contractors. Reduced surface water availability triggered increased groundwater pumping, with groundwater levels in many parts of the state dropping 50 to 100 feet below their previous historical lows. (DWR 2014). Because of the region’s degraded but significant groundwater reserves, the IRWM Plan Area suffered severe regulatory surface water irrigation curtailments and wildfire-related damages, but was spared the cataclysmic drought impacts suffered by other regions in the Sierra Nevada.

3.5.5.2 Floods

Flooding within the region can occur from three sources: (1) rainfall and runoff exceeding the capacity of local watercourses, (2) rainfall and runoff to depressions causing localized areas of shallow flooding, and (3) flooding from failure of a dam. Overall, the most significant flood hazard areas are in the Sierra Valley and the Indian Valley areas of the region. Another significant flood hazard area is located along Spanish Creek and its tributaries north of and around the community of Quincy. As previously described, the region contains an extensive network of rivers and other watercourses that flow out of higher elevations to the valley areas. The Federal Emergency Management Agency (FEMA) has identified several areas of the region as within 100- and 500-year flood zones (Figure 3-8). These areas are primarily located in or near the communities of Chester, Greenville, Crescent Mills, Taylorsville, Quincy, Vinton, City of Portola, City of Loyalton, and Graeagle.



Upper Feather River Integrated Regional Water Management Planning Area

Figure 3-8
FEMA 100 Year Flood Zones

Note: Due to scale, map does not show all flood zone details. Sierra County data not available from FEMA.

- Upper Feather River IRWM Planning Area
- Major Stream or River
- Streams
- FEMA 100 Flood Zone
- National Park
- County

0 2.5 5 10 15
Miles

Cartography by Deer Creek GIS
www.deercreekgis.com

Flooding in the region typically occurs in the winter and spring and is caused by heavy snowpack that is melted by severe rainfall events. This type of flooding rises slowly and can have lengthy runoff periods. Other flooding types include dam failure or debris flows, most likely from burned areas.

Severe flooding in the UFR IRWM region occurred in 1861-62 ("The Great Flood"), 1937-38, 1942, 1962, 1964-65, 1966-67, 1969-70, 1974, 1982-83, 1986, and 1996-97 (DWR 2013b). The most severe flooding in the region is typically produced by warm rainfall events on heavy snowpack. In 1986, the largest total rainfall for the period was 49.6 inches, recorded at Bucks Lake for the 10 day period between February 11 and 20. Storm totals of 20 to 30 inches were common for many locations. In the upper Feather River basin, flood peaks were the highest on record. State Highway 70, which follows the North Fork Feather River, was closed for several months because of washouts, landslides, and damaged bridges. The peak discharge of record for the Feather River, as measured at Lake Oroville, was 161,000 cfs on January 2, 1997 (ibid).

Climate records indicate a trend toward heavy rainfall events with little to no snowpack. Additionally, increased climate temperatures increase the risk of catastrophic wildfire, which can result in debris flow floods during heavy rain events.

3.5.6 Climate Effects on Water Supply

See Chapter 8 *Climate Change* for discussion on the climate effects on water supply.

3.5.7 Water Supply and Demand

3.5.7.1 Urban Water Demands

Population in the Plan Area outside of Butte County is expected to continue its current downward trend through 2030 (Table 3-9). Population in Butte County is projected to increase by approximately 13 percent between 2015 and 2030; however, that increase is not expected in the rural portions of eastern Butte County in the Plan Area (Dept. Finance 2016). Given the expected modest declines in population in most of the Plan Area, urban water demands are not expected to increase in the next 15 years.

In Plumas County, 62 percent of urban water use is for industrial and commercial uses and the remaining 38 percent is for residential uses. In Sierra County, 75 percent of urban water use is for residential uses and 25 percent is for industrial and commercial uses. The current estimate of domestic water use for the Sacramento River Hydrologic Region is 286 gallons per capita per day; however, the rate of domestic water use in the UFR Plan Area is likely much lower than that, as domestic water use in the region is dominated by water use habits in the more urbanized areas of the Sacramento Valley. In general, factors in water consumption such as landscaping, swimming pools, and house size are likely lessened in the Plan Area compared to larger cities and suburbs.

It is difficult to quantify existing and projected water supply/demand in the Region, in large part because much of the population utilizes private wells. Further, water districts and municipal water service providers within the Region are very small and don't meet the threshold requirements that trigger preparation of urban water management plans (UWMP), which would evaluate water supply and demand. Another limiting factor is that the majority of the districts and municipal water service providers serve disadvantaged communities and funding for long range planning and assessments are limited.

Table 3-9. Population Projections for the Upper Feather River IRWM Plan Area

County	2013 Population in the Plan Area	2030 Projected Change for the County (%)[4]	2030 Projected Population in the Plan Area
Butte[1]	9,323	--[5]	9,323
Lassen[2]	1,774	--[6]	1,762
Plumas	18,606	-0.7	18,476
Shasta	0	n.a.	0
Sierra[3]	1,496	-7.7	1,381
Tehama	0	n.a.	0
Yuba	0	n.a.	0
Total	31,199	--	30,942

[1]**Concow and Oroville East CDPs**
[2]**Westwood and Clear Creek CDPs**
[3]**Calpine, Sattley, Sierraville, Loyalton, and Sierra Brooks CDPs**
[4]**Source: California Department of Finance**
[5]**Butte County is projected to increase by 12.9 percent; however, that reflects projected growth in the urban areas of the county. Concow CDP declined in population 2010-2013, and Oroville East is downstream of the Plan Area and its water use is inseparable from that of the City of Oroville, which is not analyzed in this plan**
[6]**Lassen County is projected to increase by 8.6 percent; however, that reflects projected growth in Susanville. The portion of Lassen County in the Plan Area is assumed to be demographically identical to Plumas County for this analysis.**

3.5.7.2 Agricultural Water Demands

The most recent publicly available data on agricultural land use in California are from 2010, and the earliest are from 1998 (DWR 2015a). The DWR Detailed Analysis Unit (DAU) #154 – *Feather River* corresponds closely to the Upper Feather River IRWM Plan Area and data from that DAU were used in this analysis. In 2010, the Plan Area contained 61,678 acres of irrigated cropland, 72 percent of which was irrigated pasture (Table 3-10). This represented an increase of 10,678 acres (21 percent) of irrigated cropland since 1998. Irrigated cropland totals in the Plan Area fluctuated between 50,800 and 57,000 acres over the decade prior to 2008, and then increased to 61,121 acres between 2008 and 2009 when the acreage of irrigated pasture increased by 8,500 acres.

For comparison, the Plumas County Agriculture Commissioner's 2011 Annual Crop Report for Plumas and Sierra counties reported a total of 60,000 acres of irrigated agricultural land, 77 percent of which was irrigated pasture. This comparison is not exact, but is reasonably close, as the agricultural acreage in the Plan Area is zero or negligible for Shasta, Tehama, Lassen, and Butte counties, and nearly all of the agricultural land in Sierra County is in the Plan Area.

Using water application rates reported by DWR for each crop type, agriculture in the Plan Area used 185,295 AF of water for irrigation in 2010 (DWR 2010) (Table 3-10). Based on the most recent publicly available data, agricultural land in the Plan Area is fairly stable at 60,000 to 62,000 acres, approximately 75 percent of which is irrigated pasture. Future shifts away from irrigated pasture and toward alfalfa and grain cultivation would reduce agricultural water use in the Plan Area, as those latter crop types have a lower irrigation rate. Irrigation rates may decrease in years with higher rainfall, or may increase during droughts, as natural precipitation makes up more or less of the total water demand of the crop.

Table 3-10. Agricultural Water Use in the Upper Feather River IRWM Plan Area

Crop	2010 DWR (ac.)[1]	Irrigation Rate (AF/ac.)[1]	Annual Water Use (AF)	2011 Plumas/Sierra (ac.)[2]
Grain	9,117	2.68	24,434	6,260[3]
Alfalfa	8,143	2.67	21,742	7,290
Irrigated Pasture	44,230	3.10	137,113	46,450
Truck Crops	75	2.30	1,725	--
Apples, apricots, cherries, figs, walnuts, etc.	18	3.14	57	--
Citrus, dates, avocados, olives, etc.	82	2.39	196	--
Vineyard	13	2.12	28	--
Total	61,678	--	185,295	60,000

[1]Source: DWR Agricultural Land and Water Use Estimates: http://www.water.ca.gov/landwateruse/anaglwu.cfm
[2]Source: Plumas County. Agriculture Commissioner 2011 Annual Crop Report
[3]Ibid. The report lists grain hay and meadow hay as separate categories, and includes "grain" in miscellaneous crops. For this analysis, grain hay and meadow hay are assumed to be equivalent to "grain" in the DWR reports, as the total acreage is similar.

3.5.7.3 Environmental Water Demands

Environmental waters are waters set aside or managed for environmental purposes that cannot be put to use for other purposes in locations where the water has been reserved or otherwise managed. The California Water Plan Update Bulletin 160-98 defines environmental water as the sum of the following:

1. Dedicated flows in state and federal Wild and Scenic Rivers,
2. Instream flow requirements established by water right permits, CDFW agreements, court actions, or other administrative documents,
3. Bay-Delta outflows as required by SWRCB, and
4. Applied water demands of managed freshwater wildlife areas.

Though it is important to recognize environmental uses as components of total water use, specific data for water rights, Bay-Delta outflow, and applied water demand for managed freshwater wildlife areas are not quantified in this document. Although more than 1,000 irrigation water rights or applications occur in the watershed, their volume, point of diversion, specified use, and timing of use are not quantified in this document. Without this knowledge a comprehensive environmental water demand forecast cannot be calculated. The Bay-Delta outflows will not be examined because the downstream terminus of the Plan Area is Lake Oroville; and although water from Lake Oroville is dedicated to the Bay-Delta, it is part of a forecast for the Lower Feather River Watershed and, thus, is not a part of the Upper Feather River Watershed environmental demand forecast. Finally, none of the five freshwater wetland areas in the Sacramento River Hydrologic Region are in the Plan Area. Environmental water demand presented in this chapter will focus primarily on the dedicated flows in the Middle Fork of the Feather River, which has been designated as a federal Wild and Scenic River, and on the instream flow requirements for the Feather River.

In California, flows in Wild and Scenic Rivers constitute the largest environmental water use. Designated flows for Wild and Scenic Rivers are available to downstream users. Approximately 78 miles of the Middle Fork of the Feather River in the UFR IRWM Plan Area is designated a Wild and Scenic River. Once Middle Fork Feather River water flows into Lake Oroville, it is available for other uses. In 1995, the DWR calculated the water demand for Middle Fork Feather River as 1,192 AF per year in an average year and 497 AF per year in a drought year. The DWR projected that the same flows will be available to the Middle Fork Feather River in 2020.

Instream flow is the water maintained in a stream or river for beneficial uses such as fisheries, wildlife, aesthetics, recreation, and navigation. Instream flow is a major factor that influences the productivity and diversity of California's rivers and streams. It is difficult to forecast future regulatory actions and agreements that could change existing instream flow requirements. Thus, for this environmental demand forecast, only the projected instream flow requirements for the Feather River that were calculated by the DWR are presented. The DWR states that their calculations are "simplifications of reality," as their approach undercounts applied instream flow requirements on streams having multiple requirements, such as the Feather River. The DWR calculated that the instream flow requirements of the Feather River in 1995 were 880 AF per year in an average year and 588 AF per year in a drought year. The DWR projects that the same instream flow will be required in 2020.

3.6 Water-Related Infrastructure

3.6.1 Surface Water Infrastructure

The City of Portola and Crocker Mountain receive surface water from Lake Davis. Additionally, the town of Greenville has the option to utilize surface water from Round Valley Reservoir. Local public agencies are responsible for these systems (City of Portola, Grizzly Lake Community Services District, and Indian Valley Community Services District, respectively) (Plumas County 2009, p. 30).

The State Water Project depends on a complex system of dams, reservoirs, power plants, pumping plants, canals, and aqueducts to deliver water to users (see Section 3.6.1.2 *State Water Project* for more detail).

3.6.1.1 Dams and Reservoirs

Major water-related infrastructure includes SWP storage facilities, along with the SWP's Grizzly Valley Pipeline running from Lake Davis to the City of Portola. Additionally, the USFS operates five dams, and several small dams are owned and operated by private individuals. Altogether, there are 40 dams and diversions in the Plan Area (Table 3-11), not including the small diversion dams and points of diversions throughout the region.

The Department of Water Resources and PG&E have significant facilities in the region with a number of implications for water supply and water quality. Under the Monterey Settlement Agreement, DWR has agreed to deliver SWP water to the Plumas County Flood Control District based on the availability of water in Lake Davis, regardless of the annual statewide allocation percentage for SWP deliveries. DWR also agreed to confer with the Plumas County Flood Control District to develop strategies and actions for the management, operation, and control of SWP facilities in Plumas County in order to increase water supply, recreational, and environmental benefits to Plumas (ibid).

Table 3-11. Dams and Diversions in the Upper Feather River IRWM Plan Area

Dam Name	Owner	County	Stream	Capacity (AF)	Height (ft)	Year
Antelope	DWR	Plumas	Indian Creek	22,566	113	1964
Bidwell Lake	Private	Plumas	No Canyon Creek	5,200	35	1865
Bucks Diversion	PG&E	Plumas	Bucks Creek	5,843	99	1928

Dam Name	Owner	County	Stream	Capacity (AF)	Height (ft)	Year
Bucks Storage	PG&E	Plumas	Bucks Creek	10,300	122	1928
Butt Valley	PG&E	Plumas	Butt Creek	49,800	84	1924
Caribou Afterbay	PG&E	Plumas	North Fork	2,400	164	1959
Chester Diversion	Sac-SJ Rec Board	Plumas	North Fork	75	47	1975
Concow	Thermalito Table Mtn ID	Butte	Concow Creek	6,370	94	1925
Cresta	PG&E	Plumas	North Fork	4,400	103	1949
Eureka	DPR	Plumas	Eureka Creek	220	29	1866
Faggs Debris	USFS	Plumas	Tr. Willow Creek	50	10	1900
Forbestown Diversion	South Feather Water and Power	Butte	South Fork	358	99	1962
Frenchman	DWR	Plumas	Last Chance Creek	55,477	129	1961
Grizzly Creek	Private	Plumas	Big Grizzly Creek	140	39	1915
Grizzly Creek	Private	Butte	Grizzly Creek	76	50	1964
Grizzly Forebay	PG&E	Plumas	Grizzly Creek	1,112	92	1928
Grizzly Valley	DWR	Plumas	Big Grizzly Creek	83,000	115	1966
Indian Ole	PG&E	Lassen	Hamilton Creek	24,800	26	1924
Jamison Lake	USFS	Plumas	Little Jamison Creek	300	15	1902
Lake Almanor	PG&E	Plumas	North Fork	1,308,000	130	1927
Lake Madrone	Lake Madrone Water District	Butte	Berry Creek	200	35	1931
Little Grass Valley	South Feather Water and Power	Plumas	South Fork	93,010	210	1961
Long Lake	Graeagle Water Co	Plumas	Gray Eagle Creek	1,478	12	1938
Lost Creek	South Feather Water and Power	Butte	Lost Creek	5,680	122	1924
Lower Three Lakes	PG&E	Plumas	Milk Ranch Creek	606	32	1928
Lundy Ditch	Plumas Pines Golf Course	Plumas	Jamison Creek			
Oroville	DWR	Butte	Feather River	3,537,577	742	1968
Palen	Private	Sierra	Antelope Cree	146	25	1951
Philbrook	PG&E	Butte	Philbrook Creek	5,180	85	1926
Poe	PG&E	Butte	North Fork	1,150	62	1959
Ponderosa Diversion	South Feather Water and Power	Butte	South Fork	4,750	157	1962
Rock Creek	PG&E	Plumas	North Fork	4,660	120	1950
Round Valley	PG&E	Butte	West Branch	1,147	30	1877
Silver Lake	Soper-Wheeler Co	Plumas	Silver Creek	650	21	1906
Sly Creek	South Feather Water and Power	Butte	Lost Creek	65,050	271	1961
Smith Lake	USFS	Plumas	Wapanusie Creek	400	14	1909

Dam Name	Owner	County	Stream	Capacity (AF)	Height (ft)	Year
Snag Lake	USFS	Sierra	Tr. Salmon Creek	106	8	1885
South Fork Diversion	South Feather Water and Power	Plumas	South Fork	88	70	1961
Spring Valley Lake	CDFW	Plumas	Rock Creek	75	11	1979
Taylor Lake	USFS	Plumas	Tr. Indian Creek	380	14	1929
Walker Mine Tailings	USFS	Plumas	Dolly Creek	1,200	30	unknown
[a]ESF, 2005, p. 4-29. Available: http://www.feather-river-crm.org/pdf/MOU/IRWMP_063005.pdf, p. 4-19						

3.6.1.2 Hydroelectric Infrastructure

The other most notable infrastructure is PG&E's Stairway of Power, a series of ten hydroelectric projects on the North Fork of the Feather River stretching from Lake Almanor to Lake Oroville (Figure 3-9) (Plumas Co. 2009, p. 19). The East Branch of the North Fork of the Feather River serves over 4.36 million electrical customers through its hydroelectric facilities. Lake Almanor is a very popular water-based recreation destination in the West.

The PG&E operations in the Upper Feather River Region are governed largely by the terms of licenses issued by the Federal Energy Regulatory Commission. A settlement agreement and the license were completed for Project 1962 (Rock Creek/Cresta) in 2000, and a settlement agreement was completed for Project 2105 (Lake Almanor) in 2004. The license for Lake Almanor is currently under review by the State Water Resources Control Board for purposes of a Clean Water Act Section 401 water quality certification. Licenses for Project 2107 (Poe), Project 2088 (South Feather) and Project 2100 (Oroville) are also pending, and Project 619 (Bucks Lake) began relicensing in 2012 (Plumas Co. 2009, p. 30).

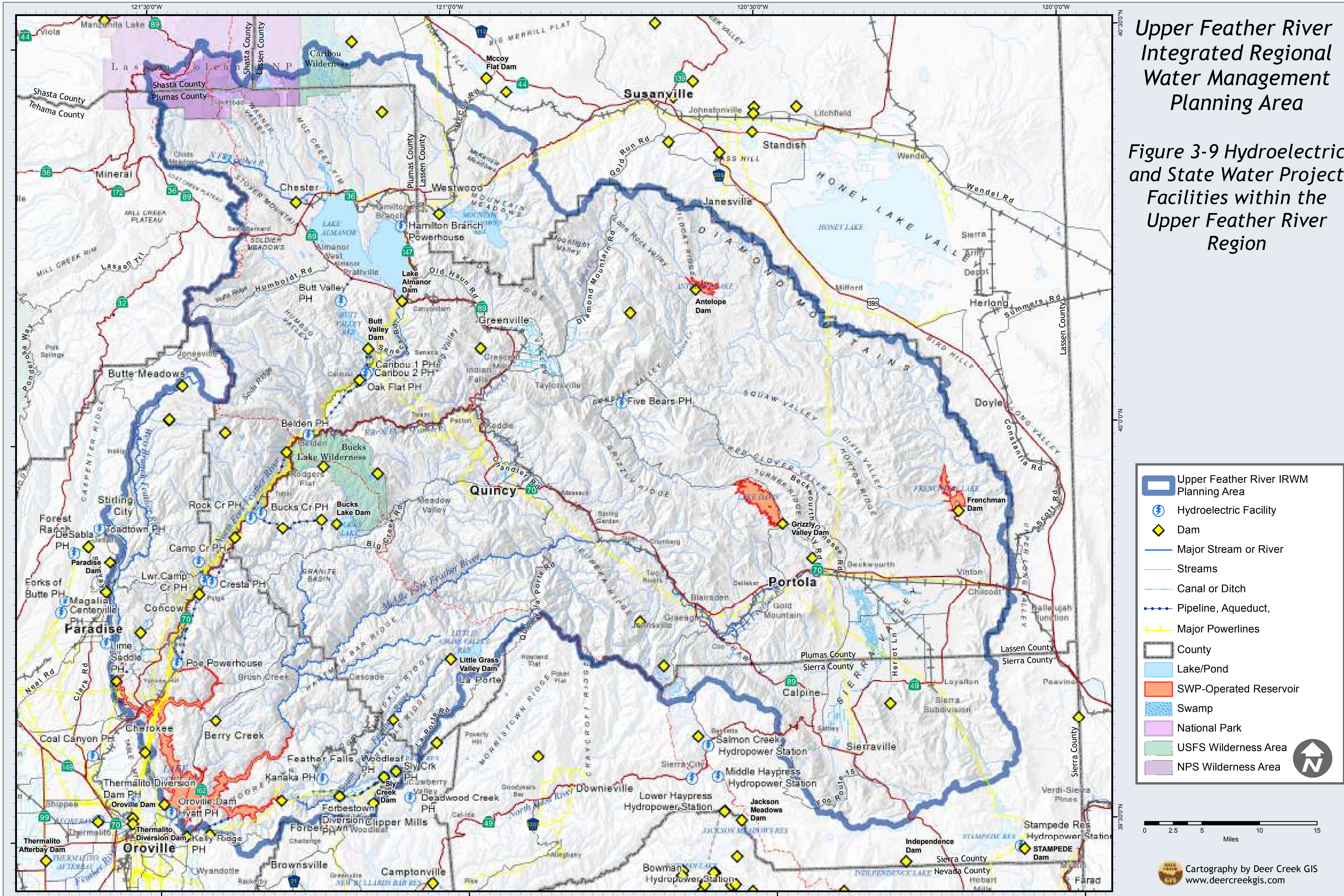
The settlement agreements for FERC Projects No. 1962, No. 2100, and No. 2105 are included as some of the underlying "mandatory plans" in the 2005 IRWM Plan. These plans include conditions that provide improved flows for fish habitat and recreation. The agreements also include investments in recreation infrastructure. The settlement agreement for Project 2105 includes significant upgrades to campgrounds around Lake Almanor. The Oroville Settlement has a total mitigation package valued at a billion dollars.

The FERC Project No. 1962 license established an Ecological Resources Committee (ERC), whose members serve as an adaptive management committee for license implementation in the central portion of the Feather River Canyon. Participants in the ERC meetings have typically included PG&E, the USFS, Plumas County, the CDFW, federal wildlife and fishery agencies, American Whitewater, local water recreation and trails groups, the California Sportfishing Protection Alliance, and the SWRCB. Many of these parties were also involved in the FERC No. 2100, No. 2105 licensing collaborative discussions and the FERC No. 2107 relicensing. Now they are actively engaged in the relicensing of the Bucks Lake Project (FERC No. 619) (Plumas Co. 2009, p. 31). Tribal representation was particularly important in the latter proceedings as tribes established their connections and asserted their land and water rights in the project-affected areas.

Related to PG&E operations, the Pacific Forest and Watershed Lands Stewardship Council is in the process of divesting PG&E lands that are not needed for hydroelectric operations by developing land conservation and management plans (Stewardship Council 2007). The Bucks Lake Planning Unit in the Feather River Region was one of four "pilot projects" in which the Stewardship Council sought to refine its process. Six entities--Plumas National Forest, Plumas County, Greenville Rancheria, Enterprise Rancheria, Plumas Corporation, and Feather River Land Trust--submitted statements of qualification and were approved as qualified recipients to potentially receive watershed lands in fee title or to hold a conservation easement

Upper Feather River Integrated Regional Water Management Planning Area

Figure 3-9 Hydroelectric and State Water Project Facilities within the Upper Feather River Region



Cartography by Deer Creek GIS
www.deercreekgis.com

over the planning unit. Ultimately, one collaborative land conservation proposal was submitted jointly by Plumas County, Greenville Rancheria, and Enterprise Rancheria. The proposal is currently under review by the Stewardship Council (Stewardship Council 2007).

The Stewardship Council began work on the Lake Almanor, Mountain Meadows, Butt Valley, and Humbug Valley planning units in 2009. Plumas County is involved with PG&E and the Council in coordinating stakeholder meetings to identify interests and issues among a number of parties, including the Maidu Summit Consortium, the federally recognized Susanville Indian Rancheria and the Greenville Rancheria, individual Maidu leadership, the USFS, the Department of Fish and Wildlife, the Mountain Meadows Conservancy, and the Feather River Land Trust.

3.6.1.3 State Water Project

The Upper Feather River Region is the headwaters for the State Water Project, providing 3.2 million AF annually of high-quality water for irrigation, drinking water, recreation, fisheries, and energy.

The SWP depends on a complex system of dams, reservoirs, power plants, pumping plants, canals, and aqueducts to deliver water to users more than 500 miles away from this headwaters region for Lake Oroville (see Section 3.6.1.1) (Figure 3-9). The SWP infrastructure in the Feather River Watershed begins with Lake Davis, Frenchman Lake, and Antelope Lake, three small lakes on Feather River tributaries. The branches and forks of the Feather River flow into Lake Oroville and then through a complex system of power plants, down the Feather River into the Sacramento River to the Sacramento-San Joaquin Delta. In the north Delta, some water is pumped into the North Bay Aqueduct to supply Napa and Solano counties. Flows also feed the South Bay Aqueduct to serve Alameda and Santa Clara counties. The remaining water flows into the California Aqueduct to serve communities in Southern California.

Lake Oroville, created by the three major forks of the Feather River, is the largest of the SWP's storage facilities, with a storage capacity of 3.5 million AF of water/yr. The East Branch, North Fork of the Feather River, which is contained completely within the region, provides 25 percent of SWP water, which provides 48 percent of the developed municipal and industrial surface water supplies in California (ESF 2005, p. 4-28).

3.6.1.4 Flood Management Infrastructure

Flood control infrastructure in the region is owned by either PG&E or the DWR and is typically managed as part of operations related to hydroelectric generation and water storage facilities. Facilities include Lake Almanor, the Stairway of Power dams in the Feather River canyon that culminate in Lake Oroville, and Oroville Dam itself in the lowermost portion of the region.

A separate facility, the Chester Flood Control Channel, was constructed by the Army Corps of Engineers to address concerns over flood control in Chester. Known locally as the "super ditch," it is located along Highway 36 and diverts excess water around Chester and directly into Lake Almanor. Another flood management infrastructure in the region consists primarily of culverts to address localized roadway flooding.

3.6.2 Groundwater Infrastructure

Municipal water supplies are based primarily on groundwater sources, which are managed by a number of local special districts (CSDs, PUDs), small private water systems, and individual well owners (Table 3-2) .

3.6.3 Wastewater Infrastructure

Most of the population is located in the larger communities that have community wastewater systems. The largest exception is the community of Graeagle which relies upon septic tanks. Septic tanks are also used by dispersed populations living outside the main communities.

Recent developments, such as those served by the Grizzly Ranch Community Services District and the Walker Ranch Community Services District, are designed to recycle wastewater for irrigation purposes.

3.7 Water Quality

3.7.1 Water Quality Regulations

Water resources in the Plan Area are subject to federal and state regulations (Table 3-12).

Table 3-12. Summary of Applicable Regulations for Water Resources in the Upper Feather River IRWM Plan Area

Regulation	Summary
Federal	
Executive Order 11988	Local governments under this order are required to pass and enforce a floodplain management ordinance that specifies minimum requirements for construction within 100-year flood plains.
Clean Water Act	Establishes basic structure for regulating discharges of pollutants into "waters of the United States." Administered by the U.S. Army Corps of Engineers.
Clean Water Act Section 303 (d) Impaired Waters List	Requires that States establish Total Maximum Daily Load (TMDL) for listed pollutants originating from point and nonpoint sources and requires levels of treatment to achieve compliance with water quality objectives.
Safe Drinking Water Act	Ensures safe drinking water for the public.
State	
California Department of Water Resources (DWR), Division of Safety of Dams	Places responsibility for the safety of non-federal dams and reservoirs under the jurisdiction of DWR.
Porter-Cologne Water Quality Control Act	Requires that regional water quality control boards establish water quality objectives while acknowledging that objectives may be changed as long as present and anticipated beneficial uses are not unreasonably impacted and water quality reduced.
State Water Resources Control Board	Established by the State Legislature, has authority over water resources allocation and water quality protection within the state. Note: Some water rights in the region have been established by court decree.
Central Valley Regional Water Quality Control Board	Authorized by the Porter-Cologne Act, the Central Valley RWQCB protects the quality of the waters within its jurisdiction for all beneficial uses. Plumas County is within the Central Valley RWQCB.

Regulation	Summary
NPDES General Permit for Discharges of Stormwater Associated with Construction Activities	Requires a General Construction Permit and implementation of a Stormwater Pollution Prevention Plan (SWPPP) for construction activities of 1 acre or more of land.
General Permit for Storm Water Discharges Associated with Industrial Activities	Requires an Industrial General Permit (IGP) for industrial activities. The IGP requires the implementation of best management practices, a site-specific Storm Water Pollution Prevention Plan (SWPPP), and monitoring plan. The IGP also includes criteria for demonstrating no exposure of industrial activities or materials to storm water, and no discharges to waters of the United States.

Water quality concerns are identified when monitoring data exceeds the standards set to protect beneficial uses. Some stream segments are listed as "impaired" by various contaminants. Impairment means that a standard of water quality for beneficial uses (for example, as a source of drinking water or for recreation or industrial use) is not being met. The federal Clean Water Act requires states to maintain a listing of impaired water bodies for the purpose of establishing Total Maximum Daily Loads (TMDLs). A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that load among the various sources of that pollutant.

3.7.1.1 Potable Water

Potable water supplies in the Feather River Watershed come from both surface and groundwater, with the majority from surface water. During drought years, additional groundwater is pumped to compensate for reduced surface water supplies. In Sierra County, a majority of supply water is from surface sources (94 percent).

Groundwater sources, both privately owned and publicly operated, occur mostly in the valleys on the east side of the Sierra Crest. Sierra Valley, the largest valley in the watershed, contains a large aquifer (DWR Bulletin 118) identified as a medium priority groundwater basin subject to compliance with the recent sustainable groundwater management legislation.

State Water Project water sources comprise a large part of supplied water for the Plan Area (ESF 2005, p. 4-27) with the Feather River Watershed supplying 3.2 million AF per year for downstream urban, industrial, and agricultural use. Lake Oroville is the largest of the SWP's storage facilities, with a storage capacity of 3.5 million AF of water per year; it represents 60 percent of the SWP's reservoir storage capacity. The East Branch North Fork Feather River alone, which is contained completely in Plumas County, provides 25 percent of SWP water.

3.7.1.2 Wastewater Discharge

Wastewater service in the region is addressed in several ways including on-site septic systems, community septic systems, and community wastewater treatment plants. Public wastewater and sewer system needs have been developed for various districts in the region. All of the region's treatment plants, including those operated by municipalities or wastewater management districts, are regulated under a permit issued by the RWQCB.

The Clean Water Act established the basic structure for regulating discharges of pollutants into "waters of the United States." The act specifies a variety of regulatory and non-regulatory tools to sharply reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. Sections 303 and 304 provide for water quality standards, criteria, and guidelines.

- Section 401 requires every applicant for a federal permit or license for any activity that may result in a discharge to a water body to obtain a water quality certification that the proposed activity would comply with applicable water quality standards. Through the Waste Discharge Requirements (WDR) Program, the SWRCB regulates point discharges that are exempt from the Federal Water Pollution Control Act through issuance of NPDES permits for wastewater treatment system discharges.
- Section 402 regulates point- and nonpoint-source discharges to surface waters through the National Pollutant Discharge Elimination System (NPDES) program. In California, the State Water Resources Control Board (SWRCB) oversees the NPDES program, which is administered by the RWQCBs. The NPDES program provides for both general permits (those that cover a number of similar or related activities) and individual permits. Anti-backsliding requirements provided for under CWA Sections 402(o) (2) and 303(d) (4) prohibit slackening of discharge requirements and regulations under revised NPDES permits. With isolated/limited exceptions, these regulations require effluent limitations in a reissued permit to be at least as stringent as those contained in the previous permit.
- Section 404 of the CWA establishes a program to regulate the discharge of dredged and fill material into waters of the U.S., including some wetlands. Activities in waters of the U.S. that are regulated under this program include fills for development, water resource projects (e.g., dams and levees), infrastructure development (e.g., highways and airports), and conversion of wetlands to uplands for farming and forestry.

3.7.2 Current Water Quality Conditions

3.7.2.1 Surface Water

Overall, water quality in the Plan Area is considered good; however, most of the main stem(s) of the Feather River are currently on the Clean Water Act 303 (d) list of impaired waters (listed constituencies include copper, zinc, polychlorinated biphenyls (PCBs), temperature and toxicity; Table 3-13) (SWRCB 2010) . Impaired waters include the North Fork from Lake Almanor to Lake Oroville, the Middle Fork from Sierra Valley to Lake Oroville, and the South Fork from Little Grass Valley Reservoir to Lake Oroville. Water quality constituents of general concern include temperature, sediment, and bacteria, with most impacts resulting from a variety of common land and water use practices (i.e., mining, ranching, timber harvest, road construction/maintenance and residential development). Erosion is also a legacy factor which can impact surface water quality, on the north, intermountain, and eastern portions of the Plan Area more than the western foothills (Plumas Co. 2012a). Legacy methyl-mercury contamination of fish and wildlife originating from the Gold Rush in legacy gold mines, mine features, and ~~in~~ hydroelectric and SWP reservoirs is of special concern for tribes, Audubon Society members, and the Water Boards. A Mercury TMDL proceeding is planned for the region during the next five to ten years to address toxins affecting water quality, human health and that of aquatic plants, animals, birds and fish.

Table 3-13. Impaired Waters in the Upper Feather River IRWM Plan Area (Clean Water Act Section 303(d))

Water Body	Pollutant (Source)	Total Maximum Daily Load (TMDL) Schedule
Little Grizzly Creek	Copper (Mill Tailings) Zinc (Mill Tailings)	Est. TMDL Completion: 2020
Fall River, Tributary to Feather River, Middle Fork	Unknown Toxicity (Source Unknown)	Est. TMDL Completion: 2021
Feather River, North Fork (below Lake Almanor)	PCBs, Temperature, Unknown Toxicity	Est. TMDL Completion: 2021
Feather River, Middle Fork (Sierra Valley to Lake Oroville)	Unknown Toxicity (Source Unknown)	Est. TMDL Completion: 2021
Feather River, South Fork (Little Grass Valley Reservoir to Lake Oroville)	PCBs and Unknown Toxicity (Sources Unknown)	Est. TMDL Completion: 2021

3.7.2.2 Groundwater Quality and Water Quality from Storage Facilities

The review of groundwater quality for the vulnerability analysis focuses on nitrate, salinity, and pesticides. Other constituents of concern are reviewed as necessary, based on documented occurrences. In the Sierra Valley, "the poorest quality groundwater is found in the central west side of the valley where fault-associated thermal waters and hot springs yield water with high concentrations of boron, fluoride, iron, and sodium. Several wells in this area also have high arsenic and manganese concentrations (DWR 2003). In this subwatershed, groundwater quality impacts, when they occur, tend to be linked to natural geologic conditions, and not so much from agricultural impacts, due to low irrigation and fertilizer and pesticide inputs. In addition, population is sparse, and impacts due to septic systems are not expected (No. CA Water Assoc. 2014a).

Lowering of summer water tables and depletion of shallow aquifers can be consequences of headcutting in streams throughout the Region where increased incision of streams in channels become hydrologically isolated from their historic floodplains. Poor retention of precipitation occurs when headcutting lowers water tables. When vegetation changes to more xeric types, active rehabilitation work on streams may restore water tables and shallow aquifers when headcutting is reversed and as riparian and upland vegetation recovers.

However, a few portions of the Region are experiencing dry-year depletions of groundwater systems as a result of continued extraction and reduced recharge during drought periods. In these areas, a more holistic approach to integrating surface and groundwater and land management practices is being recognized and tested during lower precipitation years. Sierra Valley is an example of a high desert groundwater basin, developed for agriculture in the late 1800s. Collection of groundwater data started in the late 1980s, which indicated the basin experienced periodic drought depletions that more recently, only partially recover during wet periods. Prior to the end of the 1970s most groundwater use in the valley was stock water from artesian wells. In the 1980s, many deep, large capacity irrigation wells were developed to grow alfalfa and hay crops. Significant groundwater declines have developed in the most heavily pumped areas during the last decade of intensifying drought. Since its inception in 1980, the Sierra Valley Groundwater Management District has monitored groundwater levels and installed flow meters to monitor pumping on all wells in the valley pumping 100 gpm or more. In order to manage the drought depletions, enhancement of upland and historic flood recharge areas on the valley floor are being investigated.

Nitrates

The Upper Feather River watershed NO_3 analysis is based on a review of the concentration of the most recent sampling at each well from 348 wells located in this watershed and for which records were readily available. Three percent of most recent wells had nitrate values above half the maximum contaminant level (MCL), while 1 percent of wells had nitrate values exceeding the primary MCL of 45 mg/L. The average concentration is 3.5 mg/L, well below half the MCL. It should be noted that these wells are not necessarily restricted to irrigated agricultural areas, but represent the general water quality of groundwater in the entire watershed (No. CA Water Assoc. 2014a).

The Upper Feather River watershed has almost no MCL exceedances of nitrate and TDS, and those that have been detected are not linked to irrigated agricultural impacts. There have been no reported issues of nitrate and TDS in this watershed, and other constituents of concern are generally linked to natural subsurface conditions. High vulnerability areas are considered the areas that have high nitrate and/or salinity with increasing trends in concentrations. The well sampling data generally show low nitrate and TDS concentrations even though the hydrogeologic susceptibility is high, the effective exposure to agronomic sources is very low. This, when combined with the good groundwater quality found in the alluvial basins, suggests that the UFR watershed has a low well water vulnerability under existing land and water management conditions for all basins (No. CA Water Assoc. 2014b).

Nitrate may be present in groundwater from runoff and leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits (SWRCB 2015a). The reporting standard for nitrate (as N) in drinking water changed in 2015, so it is important to distinguish between nitrate concentrations, the reporting standards, and the Maximum Contaminant Levels (MCLs). The drinking water MCL is 10.0 mg/L. The old reporting standard for Nitrate (as NO3) with a MCL of 45 mg/L ended in December 2015. Different ways of reporting the same constituent is not a lowering of the MCL.

Historically, only a few wells reported nitrate concentrations over the MCL, including a commercial well in Chilcoot and a commercial well in Beckwourth. The Chilcoot well was of unknown age and construction and was located closer to a leach field than is allowed by current Plumas County regulations. This well has since been taken out-of-service and a new well has been installed that meets the current construction standards and separation distances from leach fields. The replacement well has not exceeded the MCL.

Similarly, the Beckwourth well was destroyed and replaced with another well due to contamination in 2001. This elevated nitrate level may have been due to the proximity of the well to a sewer line. With this community on sanitary sewer, it seems likely this nitrate exceedance was localized in scope (Sipe 2016).

The only other area which has reported nitrate concentrations at 50 percent of the MCL is East Quincy in 2009. Again, with this system on sewer and no recent detections over 50 percent of the MCL, this does not seem to be a persistent or regional issue.

Appendix 10-1 of the Plan contains a community vulnerability study that provides a methodology for assessing the nitrate pollution risks for disadvantaged communities within high groundwater areas, and applies the "DRASTIC" approach to four communities in the Sierra Valley. The DRASTIC well vulnerability assessment approach is most useful where limited data do not indicate whether a more regional nitrate problem could emerge in the future in a groundwater pollution vulnerable area if current water and land management practices change.

Arsenic

Low concentrations of arsenic are present in groundwater throughout the region. Arsenic is thought to be from naturally occurring sources in Plumas County (SWRCB 2015a). Plumas County Environmental Health is aware of three public water systems in Plumas County that have confirmed arsenic levels above the MCL for drinking water: The City of Portola, Plumas Eureka CSD near Blairsden, and Grizzly Ranch CSD near Beckwourth. Additionally, Calpine in Sierra County is responding to an Abatement Order for arsenic in its community well.

In addition, the following areas in the county have concentrations that equal or exceed 50 percent of the arsenic maximum contaminant levels (MCL): Beckwourth, Belden, Blairsden, Chester, Clio, Crescent Mills, Cromberg, Delleker, Hamilton Branch, Humbug Valley, Johnsville, La Porte, Lake Davis, Maybe, Portola, Twain, Vinton, & West Almanor (Sipe 2016).

Perchlorate

Perchlorate is an inorganic chemical used in solid rocket propellant, fireworks, explosives, flares, matches, and a variety of industries. It usually gets into drinking water as a result of environmental contamination from historic aerospace or other industrial operations that used or use, store, or dispose of perchlorate and its salts. To date there are no known detections of Perchlorate in Plumas County (ibid).

Hexavalent Chromium

Hexavalent Chromium may be present in groundwater as a result of discharge from electroplating factories, leather tanneries, wood preservation, chemical synthesis, refractory production, and textile manufacturing facilities; as well as erosion of natural deposits (SWRCB 2015a). There are a few water sources in Plumas County with trace amounts of Hexavalent Chromium found in drinking water. These systems are located across Plumas County and include Chester, Clio, Portola, Lake Almanor Peninsula, Greenville, & Cromberg. The range of detections are from 0.28 ug/L up to 1.9 ug/L. These are well below the MCL for Hexavalent Chromium which is 10 ug/L (Sipe 2016).

3.7.2.3 Wastewater and Recycled Water Quality

All of the region’s treatment plants, including those operated by municipalities or wastewater management districts, are regulated under a permit issued by the RWQCB. However, individual septic systems serving individual residences also have the potential to impact water quality. The individual systems are of particular concern in areas where historical development has resulted in a high concentration of older septic systems that may not have been designed and constructed using current standards or that are not regularly maintained or upgraded. Additionally, nitrate contamination of groundwater is a concern, especially in areas of permeable soils and relatively shallow groundwater. The SWRCB adopted a water quality control policy in 2012, which defines criteria for siting, design, operation, and maintenance of onsite wastewater treatment systems (SWRCB 2012).

Recycled water in the region is used primarily to irrigate golf courses. Recycled water is treated to industry standards prior to application.

CHAPTER 4.0 REGIONAL WATER ISSUES

4.1 Introduction

Through a series of open meetings, the four Integrated Regional Water Management (IRWM) workgroups identified and vetted regional water management issues within the Upper Feather River (UFR) Plan area. The issues identified are directly tied to the Plan's goals and objectives and focus resource management and project recommendations for four areas of long-term interest within the UFR watershed: agricultural land stewardship; uplands and forest management; floodplain, meadow, and waterbodies management; and municipal services. Workgroups consist of stakeholders and interested individuals within the region and are open to anyone wishing to participate in the IRWM planning process. A more detailed description of the IRWM workgroups and their role in the planning process is provided in Chapter 2 *Governance, Stakeholder Involvement, and Coordination*.

4.2 Regional Water Issues

This section presents a summary of the current issues identified by workgroups during public meetings held in 2014 and 2015. Each issue is presented as a statement of the issue, followed by a brief discussion, if needed, for clarity. A summary table is provided at the end of the section (Table 4-1).

4.2.1 Agricultural Lands Stewardship

- Issue: *Lack of consistent supply of surface and groundwater*.

Variations in annual water availability and shifting management priorities, particularly of surface water resources, result in uncertainties for agricultural users regarding sources of irrigation water.

- Issue: *Too little availability of public and private lands for grazing*.

Recent efforts to emphasize resource protection on U.S. Forest Service (USFS) grazing allotments, most notably the standards and guidelines required by the 2004 Sierra Nevada Forest Plan Amendment decision, have resulted in many grazing permittees reducing their number of animal units per month (AUM) on many allotments. A few recent NEPA decisions for particular allotments have, in turn, reduced the number of AUMs allowed, similar to the operation levels that permittees have recently used to meet resource protection standards. Other recent NEPA decisions have authorized the same level of use that has been authorized for decades, but permittees often need to run fewer animals than authorized in order to meet resource standards, particularly in years of drought. There is a concern that resource protection standards that result in a reduction of the number of animals allowed to graze on U.S. Forest Service lands may put more pressure on private pastures and rangeland within the UFR watershed.

- Issue: *Capacity of groups and individuals in the agriculture community to access funding resources and provide management*.

A significant challenge to improving resource management in the region is the lack of a sufficient base of people trained and equipped in grant writing, staffing and administration to obtain and administer funds for management projects. Local groups such as the Sierra Valley Resource Conservation District (SVRCD), the Feather River Resource Conservation District, the Sierra Valley Groundwater Management District, and the Upper Feather River Watershed Group do not have enough trained staff or budget to seek and obtain grants and other outside funding, or to administer grants once obtained. The lack of capacity goes beyond grant procurement and includes capacities for management of data, fiscal, project, and people.

- Issue: *Changing climate patterns of precipitation from snow to rain and higher temperatures.*

The recent trend in the region of winter precipitation coming in the form of rain instead of snow affects the timing of water available for irrigation. Rainfall has a much lower retention time in the watershed than snow, which changes the seasonal availability of water in irrigation ditches and on non-irrigated, seasonally wet meadows. Rain is released quickly in short-duration peak flows following winter precipitation events, while snow is released slowly allowing for a more uniform flow during the summer dry season.

- Issue: *Inefficiencies in irrigation management*.

Surface irrigation via old open ditch conveyances is a highly inefficient method for water delivery and is often time consuming to manage. However, most small districts and individuals find it difficult to justify the cost of replacing open ditches with buried pipe. While converting ditches to pipelines increases water supply efficiencies, it can also mean less water being returned to the local groundwater basin and, in some places, less for habitat. This also applies to the degraded conveyance system issue identified below.

- Issue: *Degraded and inadequate surface water storage facilities*.

See discussion under next issue.

- Issue: *Degraded and inadequate conveyance system infrastructure*.

Similar to aging municipal water and wastewater infrastructure, many of the diversion dams, storage reservoirs, irrigation ditches and pipes in the region have deteriorated from age and deferred maintenance. Aging infrastructure results in inefficiencies in irrigation water management including water loss through leakage and reduced capacity of storage and conveyance infrastructure.

- Issue: *Need for greater collaboration among water users.*

There is need for greater collaboration and suitable infrastructure in the region to promote matching water quality to use and creating more efficient water use, such as treated municipal wastewater being made available for irrigation.

- Issue: *Decreasing groundwater basin recharge.*

Changes in precipitation patterns, loss of montane meadows, and increased evapotranspiration in forests with high stand densities have caused a reduction in the rate of groundwater recharge in the region. Decreasing groundwater recharge results in less groundwater available for irrigation from wells. Furthermore, as in recent years, drought places a greater reliance on groundwater for irrigation, which taxes diminishing groundwater resources.

- Issue: *Management activities in the upper watershed affect availability of water downstream for irrigation*.

Restoration projects implemented in the upper watershed affect timing and quantity of downstream flows, which could impact downstream irrigators.

- Issue: *Conflicts between upstream and downstream water rights holders*.

Upstream management activities often affect the timing and availability of water to downstream water rights holders. This problem is exacerbated by efforts to increase retention time in the upper watershed, particularly during periods of declining total water availability.

- Issue: *Over allocation of declining water supply and conflicts between current and historical uses*.

Recent declines in precipitation and groundwater supplies, combined with the increased economic importance of tourism-related water uses in the region, result in over allocation of resources and conflicts between agricultural, municipal, and environmental uses. In adjudicated areas, users are allocated flows based on current supplies and water decrees, which limits such conflicts.

- Issue: *Lack of holistic management for soil health and forage mixes*.

Improving soil health increases water holding capacity, organic matter, and improved drought resiliency. Management practices in the Plan area have tended to focus on individual goals or projects rather than holistic resource management. Compliance with the Irrigated Lands Regulatory Program (ILRP) has been supplemented with ongoing research efforts funded through Proposition 50. Additionally, coordination through the IRWM process is anticipated to facilitate sharing and problem solving among land managers within the region.

- Issue: *Burdensome regulations and lack of resources for compliance*.

Regulations in the Plan area are enforced by numerous local, state, and federal agencies and often place an excessive burden on water users, and individuals and groups lack the time, money, and leadership required to comply. Also, Central Valley Regional Water Quality Control Board (CVRWQCB) waivers of waste discharge requirements for agricultural operations in the Plan area are tied to overall watershed water quality that is affected by sources of pollution other than agriculture.

- Issue: *Lack of resources for water quality management of agricultural and ranch lands*.

Currently, there is insufficient funding to promote improved management of agricultural and grazing lands to protect water quality in the Plan area. For example, fencing wetlands and streams to exclude cattle is costly. Additionally, agricultural land managers may benefit from technical guidance on where to locate fences, and what types of measures work best to protect water resources without negatively affecting wildlife. Much work toward complying with water quality regulations has been accomplished in the region.

- Issue*: Need for increased management of agricultural lands for wildlife habitat enhancement*.

With increased funding and education from local agencies and organizations, improvements to agricultural management practices could improve wildlife habitat in the region. Agricultural lands are managed by the owner to maximize profit, and usually sustainability, as income is derived directly from the land. While enhancing wildlife is not the main goal, they do not have to be competing activities.

- Issue: *Need for greater clarification of water rights in the region.*

Communication and understanding of existing water rights (i.e., agricultural and others such as PG&E) within the region would be beneficial to water and land managers and decision-makers within and outside the region.

4.2.2 Floodplains, Meadows, Waterbodies

- Issue: *Impacts from abandoned mines*.

Copper and gold mining in the Upper Feather River watershed has caused copper, cadmium, mercury, and zinc impairments in several of the Upper Feather River tributaries. The largest mine in the region is the Walker Mine, an inactive copper mine approximately 12 miles east of Quincy, in Plumas County. Acidic and metal-laden water (acid mine drainage) discharging from the mine portal and tailings impoundment has historically affected the nearby streams of Dolly Creek and Little Grizzly Creek. However, site improvements in 1987 and 2009 have reduced mine runoff by as much as 98 percent in Dolly Creek and recent macroinvertebrate surveys indicate good water quality conditions. While impacts from the Walker Mine site have greatly improved, hundreds of other historic mine sites exist in the watershed. Additionally, the historic practice of hydraulic mining in the region resulted in the removal of large amounts of upper soil horizons and steepening of slopes in the upper watershed.

- Issue: *Lack of collaboration between agencies and people*.

Effective, collaborative relationships among agencies, watershed management groups, and local stakeholders have been challenged over the past several years on the topic of meadow restoration, in particular. Meadow restoration efforts for the past 25 years were focused on improving water quality by reducing the sediment load and reversing the trend of warmer stream-water temperatures that were negatively affecting aquatic habitat. With recent drought conditions, downstream water users are again concerned with the need to work toward re-building strong collaborative relationships among all stakeholders (public and private) for the future management of this important headwaters region.

Active adaptive management will encourage transparency and collaboration when all stakeholders are participating, when a strong, watershed-wide monitoring program (including third-party oversight) has been established, and when a central database is maintained and available to the public. In addition, continuing and building upon the various outreach and education programs already available in the region is important for having informed stakeholder dialogue on water-related issues.

- Issue: *Tree encroachment into meadows*.

Stream incision caused by changes in flow regimes leads to drying of montane meadows by lowering the water table and severing the hydrologic connection between the stream and surrounding uplands. Many meadows have been invaded by conifer species, which lowers the water table further and contributes to continued drying of the meadows.

- Issue: *Degraded meadows.*

The most sensitive landforms in the watershed are meadow areas associated with the upper subwatersheds. Meadows are the remnant lake bottoms of highly erodible soil types, and when allowed to persist in a degraded state, are a source of large volumes of sediment to rivers and human-made infrastructure downstream. Historic, unregulated mining, logging, grazing, and related infrastructure, along with the removal of beavers, have resulted in some level of degradation in nearly every meadow of the watershed. Restoration goals have been defined for many meadows and prioritized, which has focused efforts in the region. The lack of fire in the area may also contribute to encroachment of conifers into the meadows. Meadow restoration continues through incremental progress in implementation of projects and through improved land management practices.

Restoration of degraded meadows is a priority and has numerous benefits such as protection of plant and animal species diversity and re-establishing hydrologic function. In addition, recent studies indicate that mountain meadows restored to a healthy condition have the potential to sequester up to 40 percent more carbon than degraded meadows.

- Issue: *Altered stream hydroperiod*.

Throughout the Upper Feather River watershed, incised active stream channels have reduced retention times, resulting in less water infiltration in meadows and wildfire-damaged uplands. This has led to rapid loss of precipitation to surface runoff in high peak flows, followed by greatly reduced stream flows during the summer dry season.

- Issue: *Loss of fisheries habitat*.

Water flows in the watershed are highly regulated by the Department of Water Resources (DWR) and PG&E for hydroelectric purposes and water storage for downstream users. In addition to creating insurmountable fish barriers, some of the hydroelectric dams on the Feather River create shallow reservoirs (i.e., Rock Creek and Cresta) that result in increased water temperatures. Increased water temperatures and the loss of channel pools, the loss of riparian vegetation and undercut banks, increased sediment loads, and seasonal drying of streams from decreased water retention in upland watersheds have resulted in loss of fisheries habitat throughout the region.

The Feather River watershed above Oroville dam once supported diverse and productive fish communities. A combination of anthropogenic activities have functionally removed over 150 miles of anadromous fish stream habitat from the Basin and degraded hundreds of miles of native freshwater fish habitat.

Poor watershed conditions have long been recognized by the public and resource managers. Considerable resources have been invested to improve conditions but broad-scale improvements to fish habitat from prior restoration efforts have been limited.

Preliminary results of an assessment of fish distribution and habitat conditions that is currently underway have identified several common problems in the watershed that could be addressed by improvement efforts. These problems include:

- Fish Passage: the presence of numerous barriers to fish passage. Most of these barriers are associated with roads on forested land in both public and private ownership. Others are the result of State Highways and Railroads crossings and hydro-electric and other water development infrastructure.

- Fish Stranding: There are numerous water diversions throughout the watershed, especially in the large meadow systems now currently the site of ranching and agriculture associated with cattle production. Very few of the diversions are screened which leads to the entrainment of trout in ditches and other irrigation infrastructure, and commonly leads to stranding of these fish.

- Road Erosion: Most sub-watersheds the watershed have high road densities. Most of the roads were built before the impact of roads on stream processes was fully understood. Most are unsurfaced, many are poorly drained, and many have road stream crossing with the potential to divert stormflows unto roadways. As such, they alter both sediment and flow regimes and negatively impact fish habitat. Other facilities that produce similar effects in the watershed are state and county roadways, and railroad beds.

- Vegetation with High Risk of Sustaining Severe Wildfire: Fire is an integral element of Sierra forest ecosystems. Unfortunately, suppression of fire over the past hundred years has altered natural fire regimes. The result is fires that burn at higher severity than in the past. In the short term, large fires with a high percentage of high severity burn have devastating effects on trout and trout habitat. Ground cover is removed, resulting in accelerated erosion, large wood recruitment to channels is disrupted and stream temperatures are increased.

- Pathogens: At least one fish pathogen (Whirling Disease) is known to occur in the watershed, with devastating impacts to rainbow trout. The ability of pathogens to expand their range is poorly understood. The potential for pathogens needs to be considered in any improvement activity intended to benefit native fishes.

- Non-Native Species: The basin has seen wide spread introduction of non-native fish species. While introduced trout species are valued by anglers, they do compete with native rainbow trout. As suitable habitat is constricted by climate change, the interaction between these species may become a problem for the sustainability of native populations.

- Water Diversions and Releases: The Feather River Watershed's water regime has been significantly altered, especially along the river's main stems and in the large valleys. With the exception of the Middle Branch, river flows have been altered by storage and manipulated release of flows for hydroelectric production. Reservoirs in the headwaters also store water. Flows below these facilities are highly altered. Diversions for irrigation are prevalent in the project area's large valleys. Water rights were adjudicated in most of these valleys before adequate consideration for in stream flow needs was realized.

- Habitat Connectivity: The combination of barriers, degraded habitat, reduced stream flows and increased temperatures may pose threats to the connection between habitats needed to sustain genetic diversity of the species.

➢ Issue: *Need for improved flood management*.

Flood management can decrease groundwater infiltration and promote erosion when floodwaters are not allowed to spread across floodplains and be retained, thereby resulting in high flows downstream that scour channels. In addition, loss of water retention in uplands exacerbates the problem by causing higher floodwaters in streams that then require channelization management.

➢ Issue: *Need for better grazing management on public lands*.

Grazing on lands in the upper watershed may lead to changes in the vegetation, i.e., away from grass and forb communities that have high water retention and toward shrub communities with lower water retention. Livestock may also cause soil compaction, disturbance to wetlands, physical damage to stream banks, and waste pollution.

➢ Issue: *Impacts of wildfire*.

Widespread, intense wildfires in upland forests lead to erosion and sediment discharge into streams in subsequent rain events, increased peak flows, and significantly reduced capacity for water infiltration and retention in the watershed. Additionally, recent climate change studies have focused on the substantial release of climate change emissions from catastrophic wildfires including greenhouse gases, aerosols, and black carbon.

- Issue: *Deteriorating and inadequate recreational facilities*.

Recreational facilities, including forest roads, are often poorly located and poorly maintained. Roads, campgrounds, and trails located in seasonal wetlands and meadows can cause erosion, pollution, and channelization of runoff. Forest roads are the largest source of sediment in the watershed. Many roads were designed without adequate erosion control measures and have become rutted and gullied, which further accelerates sediment discharge. Additionally, as the economy transitions from the traditional resource base towards tourism, more and better managed recreational facilities will benefit the region.

- Issue: *Loss of wildlife habitat*.

Riparian corridors are beneficial for maintaining wildlife diversity, and function as an interface between aquatic and terrestrial habitats. Riparian buffers are also important in filtering runoff from meadows and pastures, which protects water quality. A majority of the montane riparian habitat in the UFR watershed is unprotected from conversion to other land uses, and is fragmented by inconsistent land management practices. Fencing off riparian corridors, providing off-site watering, and implementing improved grazing strategies are ways in which agencies and private stakeholders can work collaboratively to help enhance this vital habitat for wildlife while protecting the interests of private landholders.

- Issue: *Lack of integration of programs*.

Water resource management in the UFR watershed has been guided over the past decade by the following eight plans and water rights decrees with authority over parts of the Plan area:

1. FERC License 1962;
2. FERC License 2105;
3. FERC License 619;
4. Monterey Settlement Agreement;
5. Feather River Watershed Management Strategy (expired 2014);
6. Feather River Coordinated Resources Management Plan;
7. Quincy Library Group Act – Management Plans for Lassen, Plumas, and Tahoe National Forests; and
8. Sierra Valley Groundwater Management District Legislation.
9. Indian Valley Decree
10. Sierra Valley Decree

Although the statutory terms of some of these plans have expired, they have shaped and continue to shape water management in the upper watershed. Each of these plans deals in part with some water management issues of the watershed, but the plans collectively do not address all water issues and do not geographically encompass the entire watershed. Additionally, local plan requirements sometimes conflict with the requirements or interests of plans in other localities, and the piecemeal nature of planning in separate jurisdictions creates difficulties in addressing issues on a watershed scale. There have also been extensive restoration and land and water management efforts by various agencies, groups, and non-governmental organizations that would benefit from a more holistic approach, rather than site- or project-specific efforts.

- Issue: *Degraded floodplains*.

Streambank and channel degradation has led to deeply incised stream channels throughout the watershed, disconnecting the channel from its historic floodplain. New floodplains usually cannot be established in the incised channels, and those that are established are often too narrow to accommodate and spread out the water during peak flows.

- Issue: *Loss of salmon from the upper watershed*.

Dams have progressively excluded salmon from the main branches of the Feather River over time, culminating in the Oroville Dam, causing complete extirpation of ocean-run salmon from the upper watershed. In addition to creating insurmountable fish barriers, some of PG&E's Stairway of Power hydroelectric dams on the Feather River create shallow reservoirs (i.e., Rock Creek and Cresta) that result in increased water temperatures. Channel incision, head cutting, and increased water temperature have also degraded potential salmon spawning habitat in the upper watershed.

- Issue: *Need for better sediment management*.

Managing all sources of sediment export from the watershed should remain a high priority to protect water quality, prevent permanent loss of soil downstream, and protect reservoirs from filling in. The primary sources of sediment loss are streambank erosion and erosion from road cuts and fill slopes.

- Issue: *Threats to listed species*.

A total of 13 species listed as threatened or endangered under federal and/or state endangered species acts occur in the Plan area (see discussion in Chapter 3 *Region Description*, Table 3-6). Many of these, including two amphibians, four birds, one mammal, and one plant are associated with riparian or aquatic habitats and are, therefore, especially sensitive to water quality issues. Declining water quality from sedimentation, increased temperature, and pollution from mines has had deleterious effects on these listed species. In addition to general watershed issues with environmental water quality, rodenticides and herbicides used in illegal cannabis cultivation leach into streams and pose a particular threat to all species that depend on aquatic habitats.

- Issue: *Declining water quality*.

Increased water temperatures, sedimentation, reduced dissolved oxygen, and potential toxins from aging debris dams (historic gold mining) remain as primary reasons for declining water quality in the watershed. While some progress has been made towards improvement, it has not removed the threat posed to aquatic species. Building on existing monitoring efforts by DWR and Plumas Corporation, in addition to outreach and education, could lead to increased awareness of the issues and a framework to guide future water quality improvement efforts.

- Issue: *Decreasing water quantity*.

Climate change models predict a 48 to 65 percent reduction in snowpack from the 1961–1990 average in the Sierra Nevada by the end of the 21st century (DWR 2015c).

A network of monitoring stations such as those established by the California Data Exchange Center (CDEC) that measures streamflow is needed throughout the watershed, particularly in the upper watersheds. These stations should be located at important confluences or below critical river reaches such that a complete picture of water quantity can be seen over time.

- Issue: *Timing of water storage and release*.

Water storage and release for uses such as agriculture, hydroelectric generation, and flood control are often incompatible with the needs of natural ecosystems. The natural hydroperiod of streams has been altered, resulting in accelerated seasonal drying of tributaries and increased "flashiness" due to decreased retention in the upper watershed, unseasonal peaks in lower reaches due to releases for hydroelectric generation, and reduced seasonal flood peaks in lower reaches.

- Issue: *Increasing sediment load in streams*.

Increased turbidity in upper watershed streams negatively affects aquatic organisms, reduces fish spawning habitat, and increases water temperature. Increased turbidity by fine sediments inhibits photosynthesis, chokes aquatic animals, fills channel pools and covers rocky substrates, and raises water temperature by absorbing solar radiation. Approximately 1.1 million tons of sediment are transported out of the Upper Feather River watershed annually (Plumas Co. 2005).

4.2.3 Municipal Services

- Issue: *Aging infrastructure*.

Twenty-two special districts provide either or both domestic water and/or wastewater services in the Upper Feather River region (Chapter 7 *Land and Water Use Planning*, Table 7-3). Infrastructure in many of these districts is old and in need of maintenance and/or upgrades. Aging infrastructure results in water loss, infiltration/inflow, broken service mains, inadequate capacity, accidental releases, and increased operating costs. The small populations in these service districts are burdened with high per-connection costs of water systems, which limit the revenue available to districts. Statutory restrictions on utility rate increases also often prevent service districts from raising needed revenue when voters reject rate increases.

- Issue: *Dam and reservoir integrity*.

There are 40 major dams and diversions in the Plan area (ibid.): the newest is 36 years old and the oldest is 150 years old (Chapter 3 *Region Description*, Table 3-10). Declining structural integrity may result in a dam leak, or force the lowering of maximum water levels to prevent failure, both of which reduce storage capacity. The risk of dam failure also poses a threat to communities downstream.

- Issue: *Inadequate storage*.

Despite the large number of dams in the watershed, many of which are owned and regulated by DWR and PG&E, there is inadequate storage to meet all the needs of water users in the region.

- Issue: *Infiltration and inflow into wastewater systems*.

Aging wastewater infrastructure can allow inflow of freshwater during precipitation events or floods. This results in flows that exceed the capacity of wastewater treatment facilities, which force releases of untreated or incompletely treated wastewater.

- Issue: *Insufficient flow capacity of wastewater infrastructure*.

Insufficient capacity in wastewater treatment facilities or collection lines can result in release of untreated or incompletely treated wastewater.

- Issue: *Insufficient operations and maintenance revenue*.

Many small special districts do not have a sufficient revenue base to cover the increasing costs of operations and maintenance. Statutory restrictions on utility rate increases often prevent service districts from raising needed revenue when voters reject rate increases. When small projects in rural communities are submitted to granting agencies, they often do not fare well when competing with larger projects in more populous areas. Small districts also have difficulty raising required matching funds.

- Issue: *Limited staff and budget*.

Many small service districts do not have enough staff to cover the increasing range of issues and tasks that water and wastewater service providers face, and lack funding to meet growing administrative needs.

- Issue: *Lack of data on location of private wells*.

A large proportion of the residents of the region rely on private wells for water. Many of these wells are vulnerable to contamination or may be located illegally. The State of California has mandated that regional water management authorities determine the location of all private wells in their management area. This is a significant effort in the region for which there is insufficient staff and funding.

- Issue: *Lack of integrated regional facilities*.

The large number of small special districts in the region can result in redundancies and inefficiencies that may be reduced by combining services, say, in larger regional facilities.

- Issue: *Financial strain of meeting regulatory requirements*.

The management and compliance responsibilities of local special districts have increased markedly under state and federal mandates. Small special districts in the region lack a sufficient revenue base to meet the increasing regulatory requirements.

- Issue: *Reservoir capacity loss*.

Increased sediment load in rivers and streams in the watershed is resulting in sedimentation of reservoirs.

- Issue: *Need for staff training and replacement*.

Local special districts and agencies are experiencing a shortage of trained staff as the current generation retires. Many operational and maintenance procedures require a certified operator of a particular grade. Local entities have not been able to train a new generation of operators, in part due to a lack of funding to support junior operators and in part due to a declining population, especially of young working people.

- Issue: *Wastewater pond/levee integrity*.

Similar to dam integrity, the declining integrity of wastewater treatment ponds leads to increased risk of leaks and failure, and to reduced capacity to avoid failure.

- Issue: *Lack of wastewater reuse programs*.

Recycled wastewater has great potential to help meet future water needs. Currently, the Plan area does not have significant wastewater recycling capacity, and developing such capacity is costly. Typical recycled wastewater must be distributed in separate parallel infrastructures.

- Issue: *Water quality*.

Municipal water in the region must be treated for high levels of toxic metals in some cases. Copper mining in the Upper Feather River watershed has caused copper, cadmium, mercury, and zinc impairments in several of the Upper Feather River tributaries. Water in the Sierra Valley is unusually high in arsenic from natural sources in thermal springs. Groundwater in the Sierra Nevada region is also unusually high in uranium from natural sources.

The Plumas Eureka Community Services District (PECSD) is a small special district that provides water and wastewater services to between 340 and 1,500 customers near Graeagle, depending on the season. Water from PECSD groundwater wells consistently exceeds standards for arsenic, iron, and manganese. Because alternative sources of water are not feasible, PECSD proposes to construct an arsenic filtration facility. The City of Portola has recently installed an arsenic filtration facility to meet state standards for drinking water quality.

- Issue: *Inadequate flood management*.

Floodwaters can enter municipal wastewater systems that then tax the flow capacity of treatment facilities and lead to release of untreated or incompletely treated wastewater.

4.2.4 Uplands and Forest

- Issue: Historic *impacts to soils from mining, roads, fires, grazing, and other land uses in the watershed continue to affect forest soil health, water quality, and groundwater infiltration*.

It is difficult to separate cumulative impacts to soils into discrete problems. The regulatory enforcement of best management practices (BMP) is effective in reducing impacts to soils from modern grazing, mining, road construction, and road drainage maintenance. However, catastrophic wildfires have significant potential to increasingly impact soil infiltration and productivity. Declines in forest soil productivity, water quality, and groundwater recharge, depend on factors such as fire severity, post fire treatments, soil characteristics and forest vigor.

- Issue: *Drought, disease, accumulation of biomass, increased stand densities, have dramatically increased the probability of catastrophic wildfire. Residential and recreational development in high fire hazard areas increases the probability of severe wildfire damages to natural resources, and human life, and property*.

Current stand densities in the region are six to eight times higher than estimates of prehistoric densities, and ground and ladder fuels have accumulated due to suppression of natural low-intensity fires. Forests today are choked by small conifer thickets that threaten the survival of mature trees from drought and severe intensity wildfire. Even age tree plantations result in dense forest stands that are especially susceptible to wildfire damage, drought, pests, and disease. Thinning forest ground and ladder fuels through tree removal and through the use of managed fire is required throughout the watershed to conserve forest productivity and drought resiliency, to reduce the risk of forest conversion to grasses and brush from catastrophic wildfires, and to begin restoring historic water infiltration capacity in forest soils and aquifers.

- Issue: *Regional wood processing facilities require upgrades in capacity to support needed forest management and economic initiatives*.

High stand densities in forests in the region increase the risk of catastrophic wildfires, increase evapotranspiration and water competition among trees, decrease groundwater infiltration and streamflows, and generally decrease forest ecosystem health. Stand thinning is needed throughout the Plan area; however, regional wood processing facilities currently lack capacity to process the increased quantities of wood waste or "biomass" that stand thinning produces. Also, capacity to produce wood products other than lumber, such as pellets, posts, biochar, forest residue soil amendments, electricity (e.g., value-added wood products from biomass), are important investments for a diverse forest-based economy in the Region. Sustainable forest stewardship is an essential component of economic recovery in this severely economically disadvantaged region as forests cover over 70 percent of the UFR land base.

- Issue: *Regional active biomass power generating facilities require upgrades in capacity to support needed forest management initiatives*.

High stand densities in forests in the Plan area increase the risk of catastrophic wildfires, increase evapotranspiration and forest moisture stress, decrease groundwater infiltration and streamflows, and generally decrease forest resiliency to drought. Stand thinning is needed throughout the Plan area; however, regional active biomass power generating facilities currently lack the economic incentives that are needed to reopen and upgrade existing biomass facilities in the Region and to diversify the utilization of increased quantities of wood biomass that stand thinning would create. The State of California has a goal of generating 6.6 percent of its total energy from biomass by the year 2020. Currently, biomass provides approximately 3 percent of total energy production and biomass electrical price support and investment lags far behind other sources of renewable energy, despite new information on the threats to global climate stability from black carbon emissions generated by forest wildfires.

- Issue: *Deficiencies in transparency, monitoring, data sharing, and integration of data into management plans have led to inefficiencies and redundancies in past management*.

Forest management was not a priority in the 2005 UFR IRWM Plan (Plumas Co. 2005), as it was incorporated into the California Water Plan (CWP) for the first time in 2013. The current record drought and the exponential increase in severe wildfires in forests have stimulated additional research and data collection. Many published studies and guidance manuals for forest management and monitoring, such GTR 220 and GTR 237, are posted in the IRWM Documents library (UFR 2016). They are referenced in public NEPA documents for proposed forest management actions on federal forest lands and will provide a scientific basis for updating USFS land and resource management plans for the Region's National Forests within the Plan implementation period.

IRWM forest improvement projects include scientific references, published data, and programs for data collection and sharing.

- Issue: *Riparian forests are declining throughout the Plan area due to stream incision, impacts to floodplains from grazing and agriculture, and groundwater depletion*.

After decades of fire suppression and reduced logging due to controversial management practices and lawsuits, conifers have invaded ecologically and culturally important stands of hardwood trees including black oak (*Quercus kelloggii*) and have greatly reduced the historic diversity of key riparian forest and streamside species such as cottonwoods, willows, and maples. Conifers also have invaded aspen (*Populus tremuloides*) groves, thereby altering wildlife habitat and aspen regeneration vigor. Reduced groundwater recharge during the dormant season--combined with shading out sunlight during the growing season--weakens riparian, aspen, and black oak stands. The suppression of managed fire and the interruption of tribal stewardship of these important forest habitats are important issues raised in the Plan update.

- Issue: *Declining rates of groundwater infiltration are changing the hydroperiod of streams in the Plan area*.

Reduced snowpack and groundwater retention throughout the watershed has led to an increase in precipitation runoff during high peak flows, followed by reduced stream flows during the summer dry season when vegetation evapotranspiration is highest. As the climate trends towards a change in precipitation from snow to rain and higher summer and winter temperatures, the current trend of reduced water retention may continue to accelerate without active watershed management.

- Issue: *Reduced groundwater availability and increasing temperatures are causing forests to convert to brush after disturbance*.

Reduced precipitation retention times from reduced snowpack storage in the upper elevation parts of the watershed, and from damaged soils in severely burned forests, can lead to rapid loss of precipitation to surface runoff. This occurrence typically results in highly turbid peak flows followed by increasingly reduced stream flows during the summer dry season. Over months and decades, effects of severe fires can vary depending on burn severities, soils, geology, precipitation, and vegetation response. The past decade (2005-2015) has included several years of severe drought. In the region's forestlands, drought stress is killing the biggest trees and threatening vast stands in mature forests. Drought also increases the flammability of dense understory forest thickets, which are "ladder fuels" for crown fires that kill mature trees. Severe multi-year, drought-stressed forest landscapes across the region are at increasing risk for destruction by catastrophic wildfire and pests and diseases. Watershed recovery after severe wildfire is identified as an increasingly important management priority along with reducing forest fuels in order to enhance and sustain watershed functions including stream hydrology and quality. Altered stream hydrology and increasingly severe wildfires threaten the future of mature forests and summer streamflow ecology, intensifying conflicts over forest and water management. Including stream hydrology rehabilitation and groundwater recharge recovery in designing ecological recovery for both unburned and severely burned mature forests and other key forest habitats, such as streams, is the focus of multiple UFR IRWM watershed and forest ecosystem enhancement and recovery projects. Initiating landscape scale and integrated approaches to forest and water conservation should help to reduce management conflicts over impaired stream hydrology as monitoring and evaluations are used to inform adaptive an integrated forest and watershed management.

- Issue: *Loss of critical riparian habitats*.

Riparian habitats in the region are valuable to wildlife and ecological processes. Stream incision and meadow drying are causing declines in riparian habitats. Riparian habitats are increasingly prone to destruction by severe fire when conifer thickets provide fire ladders into mature cottonwoods and maples in riparian forests.

- Issue: *Recent catastrophic fires have created a need for post-fire recovery efforts in burn areas*.

The natural fire regime of forests in the watershed consists of relatively frequent, low-intensity ground fires that clear the underbrush and allow for natural regeneration of forest understory vegetation. Widespread, catastrophic wildfires can result in the conversion of forest biomass and mature forest trees to black carbon greenhouse gas emissions and decaying forest carbon stocks and will require intensive recovery efforts to restore affected areas to forested conditions.

- Issue: *Tree encroachment into meadows*.

Stream incision caused by changes in flow regimes leads to drying of montane meadows by lowering the water table and severing the hydrologic connection between the stream and surrounding uplands. Conifer trees and sometimes hardwood trees including black oak (*Quercus kelloggii*) and aspen (*Populus tremuloides*), as well as sagebrush (*Artemisia tridentata*), have reduced the extent of wet meadow ecosystems in the region.

- Issue: *Reduced groundwater infiltration*.

Changes in precipitation patterns, increased forest stand densities, and impacts to soils from land use and severe wildfire can reduce the rate of precipitation that is available for groundwater infiltration and thereby, also reduce the amount of soil moisture that is available to forest trees and vegetation.

- Issue: *Increases in forest stand densities lead to increased evapotranspiration and reduced groundwater infiltration*.

Historic forest management practices and forest fire suppression have led to a marked increase in stand densities over natural conditions and what is considered optimal for forest health. High stand density increases evapotranspiration, which depletes soil moisture and dense forest canopy cover decreases groundwater infiltration.

- Issue: *Insufficient water available for forest and fire management*.

The increased frequency and extent of catastrophic wildfire also increases the demand for water for firefighting.

Table 4-1 Summary of Regional Water Issues Identified by Workgroups, 2014-2015

Workgroup	Regional Water Issue
Agricultural Lands Stewardship	
	Lack of consistent supply of surface and groundwater.
	Too little availability of public and private lands for grazing.
	Capacity of groups and individuals in the agriculture community to access funding resources and provide management.
	Changing climate patterns of precipitation from snow to rain and higher temperatures.
	Inefficiencies in irrigation management.
	Degraded and inadequate surface water storage facilities.
	Degraded and inadequate conveyance system infrastructure.
	Need for greater collaboration among water users.
	Decreasing groundwater basin recharge.
	Management activities in the upper watershed could affect availability of water downstream for irrigation.
	Conflicts between upstream and downstream water rights holders.
	Over allocation of declining water supply and conflict between current and historical uses.
	Lack of holistic management for soil health and forage mixes.
	Burdensome regulations and lack of resources for compliance.
	Lack of resources for water quality management of agricultural and ranch lands.
	Need for increased management of agricultural lands for wildlife habitat enhancement.
	Need for greater clarification of water rights in the region.
Floodplains, Meadows, and Waterbodies	
	Impacts from abandoned mines.
	Lack of collaboration between agencies and people.
	Tree encroachment into meadows.
	Degraded meadows.
	Altered stream hydroperiod.
	Loss of fisheries habitat.
	Need for improved flood management.
	Need for better grazing management on public lands.
	Impacts of wildfire.
	Deteriorating and inadequate recreational facilities.
	Loss of wildlife habitat.
	Lack of integration of programs.

Workgroup	Regional Water Issue
	Degraded floodplains.
	Loss of salmon from the upper watershed.
	Need for better sediment management.
	Threats to listed species.
	Declining water quality.
	Decreasing water quantity.
	Timing of water storage and release.
	Increasing sediment load in streams.
Municipal Services	
	Aging infrastructure.
	Dam and reservoir integrity.
	Inadequate storage.
	Infiltration and inflow into wastewater systems.
	Insufficient flow capacity of wastewater infrastructure.
	Insufficient operations and maintenance revenue.
	Limited staff and budget.
	Lack of data on location of private wells.
	Lack of integrated regional facilities.
	Financial strain of meeting regulatory requirements.
	Reservoir capacity loss.
	Need for staff training and replacement.
	Wastewater pond/levee integrity.
	Lack of wastewater reuse programs.
	Water quality.
	Inadequate flood management.
Uplands and Forest	
	Impacts to soils from grazing, mining, roads, fires, and other land uses in the watershed have reduced overall forest health, water quality, and groundwater recharge.
	Drought, disease, accumulation of biomass, increased stand densities, and residential development have dramatically increased the probability of catastrophic wildfire and the threats of wildfire to natural resources, life, and property.
	Regional wood processing facilities require upgrades in capacity to support needed forest management and economic initiatives.
	Regional active biomass power generating facilities require upgrades in capacity to support needed forest management initiatives.

Workgroup	Regional Water Issue
	Deficiencies in transparency, monitoring, data sharing, and integration of data into management plans have led to inefficiencies and redundancies in past management.
	Riparian forests are declining throughout the Plan area due to stream incision, impacts to floodplains from grazing and agriculture, and groundwater depletion.
	Declining rates of groundwater infiltration are changing the hydroperiod of streams in the Plan area.
	Reduced groundwater availability and increasing temperatures are causing forests to convert to brush after disturbance.
	Loss of critical riparian habitats.
	Recent catastrophic fires have created a need for post-fire recovery efforts in burn areas.
	Tree encroachment into meadows.
	Reduced groundwater infiltration.
	Increases in forest stand densities lead to increased evapotranspiration and reduced groundwater infiltration.
	Insufficient water available for forest and fire management.

4.2.5 Capacity

4.2.5.1 Capacity definition and needs

Many of the significant water and watershed management issues in the Upper Feather River IRWM region are rooted in environment – both the natural environment and the built environment. Issues rooted in the natural environment include trends of decreasing snow precipitation; shifts from snow to rain that result in decreases in soil retention and groundwater infiltration; changes in the frequency and intensity of precipitation events that result in higher peak flood flows and reductions of dry season stream flows; more severe drought impacts to native vegetation; increased fire risk from hotter summers and drier fuels; and increasing mature forest mortality from drought stress, pests, disease, and competition from invasive shade and drought tolerant vegetation. Issues rooted in the built environment include aging or inadequate infrastructure; land management practices that have led to degraded meadows and headwaters, unhealthy forests, and diminished water quality; land and water management practices that have led to loss of species and aquatic habitats, and altered stream hydrology; conflicting water uses during water shortage periods; and increasing water demand as temperatures rise. These environmental issues interact to create complex, and intertwined watershed management challenges for the Plan area.

A capacity issue facing the region is rooted in the cumulative management needs themselves, that is, the issue of enhancing capacity to meet those increasingly urgent and complex management needs. Capacity refers to the availability of working age residents to staff, and provide continuity in water and watershed management expertise, data, and base funding that is a prerequisite for successful competing for and implementing grants, without which the management needs of the Plan area cannot be met given the low population and economic depression that characterizes most of the region. Additionally, there is a general lack of capacity within the region to meet regulatory requirements that are typically written with larger, more intensive operations or more highly populated or resourced locations in mind.

In an average year, the State Water Project and Central Valley Project deliver approximately 10 million acre-feet of water to 23 million Californians, of which the Upper Feather River watershed contributes approximately 3.2 million acre-feet annually. Thus, the region is a major exporter of water to the rest of California, and the health of the Upper Feather River watershed is vitally important to far more than the 32,000 residents of the Plan area. The Plan area includes all of Plumas County and portions of Sierra, Butte, Lassen, Shasta, and Yuba counties. In addition, state and federal laws guarantee that water rights appropriations cannot deprive the 'Area of Origin'[1] of the water it needs for the development of the area and must adequately supply the needs of the area and its inhabitants. Investments into the region have, to date failed to match the rhetoric.

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[1] An "Area of Origin" is generally considered an area where a headwaters of a river or other significant water body originates. The "area" may be a county, region, or other geographic region of the state. The IRWM region boundary follows the watershed boundary for the Upper Feather River. Area of Origin protections emerged initially when the California legislature adopted the Feigenbaum Act in 1927, which authorized the State to file for unappropriated water to enable the State to develop the SWP (CWC Sections 10500-10507). The SWP, when operational, would divert water for export at the Delta for use elsewhere. Upstream areas became concerned about the potential loss of water, and in 1931 the Legislature amended the Feigenbaum Act to protect the rights of those sources or Counties of Origin (CWC Sections 10504-10506). California law now provides that no water rights appropriation or assignment may be granted by the SWRCB that will deprive the county in which the water originates for any such water as may be needed for the development of the county (CWC Section 10505). Areas of Origin are also protected by the federal Central Valley Project Improvement Act (later incorporated by reference into the Burns-Porter Act of 1959, Section 12931) that provides that the watershed of origin areas shall not be deprived of the prior right to all of the water reasonably required to adequately supply the beneficial needs of the watershed, area, or any of the inhabitants or property owners (CWC Section11460).

Restoring and maintaining the health of the Upper Feather River watershed benefits millions of people far beyond the watershed boundaries but requires financial resources that are not available from within the watershed itself, and so funding to implement the Plan must come from outside the Plan area. However, taking money from outsides sources obligates recipients to the conditions those sources place on the funding. Although funds are available for watershed restoration and municipal services projects, most are in the form of competitive grants rather than being available to small disadvantaged community in targeted funding pools. Small special districts, agencies, and organizations in rural areas are at a substantial disadvantage when competing with larger metropolitan areas for grant funding. Nor do poor rural communities have the financial resources to sustain efforts while waiting for grant reimbursements for expenditures.

Many small special districts and agencies are understaffed, and either lack experienced staff or the time it takes to develop and retrain staff between grants to secure and administer ongoing grant funding. Nor are funds available to pay for training or for the upfront investments in time and data collection needed to prepare a competitive application. Outside consultants may be too expensive for small districts and agencies to employ, and there simply may not be any locally affordable consultants. Competitive grants often require a substantial amount of technical data to support applications, such as water quality testing, geotechnical exploration, hydrology studies, and monitoring data, that are costly and time consuming to obtain. Past success is a principal predictor of future success in grant writing: Grants tend to be awarded to applicants with a track record of winning and implementing similar grants. This in itself discourages small districts and agencies from entering the competitive process as first-time applicants because they do not already have pilot programs or initial infrastructure in place from previous grants. Recently, the Proposition 1 DAC funding program has real potential to soften the devastating effects of this viscous cycle for the poorest urban communities in California.

Many grants require an accompanying CEQA or NEPA process, which is itself expensive, time consuming, and requires further expertise that may be lacking at the local level especially in rural poor communities. Many grants focus on specific functions, such as urban stormwater or water-use efficiency--that are not applicable to small rural communities because they don’t meet the grant eligibility thresholds. Additionally, grants may be targeted to certain regions such as the Central Valley, Delta or the coast and not to mountain communities, such as the Upper Feather River region. Difficulties in obtaining grants can also be affected by the nature of the infrastructure in the region. Very old infrastructure such as ditches and flumes dating from the 19th century, or untreated wells, may not meet the basic infrastructure definitions that grants mandate for eligibility. A very large percentage of the region is administered by the federal government; state grant money may be either unavailable or require the cooperation of a federal agency to be used in those areas. Finally, grants often require matching funds that a small district or agency or community cannot raise.

A third capacity issue is the staffing and expertise necessary to administer basic operations and funds. Because of budget limitations, small districts and agencies often cannot afford to train junior skilled technicians and operators to fill vacancies when more senior employees retire. Some service districts find that they have no staff with the required certifications to perform operations and maintenance tasks, or with the experience and training to perform certain administrative functions. Private land owners also face the issue of capacity: Agency staff and technicians are stretched thin and may not be available to provide requested guidance and support for land management activities or obtaining funds targeted at individual landowners to improve private land management practices.

4.2.5.2 Integration as means of capacity building

Fully addressing the issue of capacity in the Plan area, and in similar rural watersheds in the Sierra Nevada, will require a more holistic approach to water resources management and investment in California. Water resources should be viewed as an interconnected ecological system that extends from the highest peaks in the Sierra Nevada to the Pacific Ocean, integral to the quality of life of every human and natural community from the mountains of the upper watersheds, through the major rivers and the San Francisco Bay Delta, California's water hub, to the coastal and Southern regions of the state. Water management should also be viewed as an integrated system in which funding and administrative resources are applied wherever they are most needed and provide high public values instead of entirely through competition mechanisms that, in effect, discriminate against poor rural communities and regions. Water resources management should be integrated for regional equity, statewide, while respecting the sovereignty and value of local communities. Coordination between the California Water Plan and regional watershed plans such as the UFR IRWMP is an important step for statewide integration of equitable and effective water management. State agencies such as and the regional water boards are mandated to work for the good of all the state but often lack effective mechanisms for doing so.

Integration at a regional or watershed level can also help address the chronic under-capacity issues faced by poor rural areas. As a result of the 1993 Monterey Settlement Agreement, the DWR paid $4,000,000 to Plumas County for watershed improvement and environmental restoration. Upon final settlement of outstanding litigation, another $4,000,000 will become available to Plumas County for watershed rehabilitation and other needs. These funds were administered by the Plumas Watershed Forum (PWF) according to goals and criteria set forth in the Feather River Watershed Management Strategy. The PWF has funded high-priority projects that have demonstrated positive results in improving watershed retention and reducing sedimentation. Although the second phase of Monterey funding will not come encumbered by the requirements of competitive grants, the administrative capacity for IRWM implementation is an important regional prerequisite for administering Monterey funds for environmental restoration and other UFR IRWM water management priorities. Other examples of past capacity for integrated watershed management in the Plan area include investments into the three National Forests in the UFR region from the Herger Feinstein Quincy Library Group Act that mandated inclusion of the Quincy Library Group Stability Proposal into the forest management plans of the Plumas, Lassen, and Sierra National Forests, and the Upper Feather River Roundtable, a voluntary program for coordinating management projects with private landowners and funding sources. The 2005 UFR IRWMP itself was funded by DWR under Proposition 50, while Proposition 84 funded the 2016 update.

In summary, there are past examples of enhancing capacity for environmental resources management through integrating goals and administration at a regional scale that offer important lessons for future investment programs based on the UFR IRWM Plan and implementation. Adapting past regional integration efforts to current and future challenges would include enhancing capacity for community services in DAC communities for water, wastewater, and flood control needs and fully incorporating TEK and independent scientific review into watershed and forest restoration projects. Meeting such needs at a regional level can create opportunities for economies of scale not currently available to small local special districts; warranting cost-benefit analyses of integration and consolidation of individual small-scale projects and administrative functions. A regional wastewater treatment facility, for example, could have higher capacity, lower administrative costs, and a larger revenue base than numerous separate local wastewater facilities. A single wastewater authority for the region may take advantage of staffing efficiencies, thereby making the highest utilization of available operators as well as freeing resources for grant writing and other capacity-building functions. A wastewater authority serving most of the approximately 24,000 residents of the Plumas and Sierra county portions of the region would be more competitive for grant funding, by returning a benefit to a larger number of people, which is often a concern for funding agencies. In addition, integrating such services throughout the Plan area would address disparities of capacity and service within the region itself that are similar to the disparities between the Plan area and other regions of the state described in the previous section. Finally, regional integration of all water management would increase capacity by bringing together expertise, experience, effort, and knowledge of stakeholders with disparate interests.

4.3 Conflicts in the Region

Conflicts in the region arise mostly from the allocation of finite water resources to a variety of competing needs and uses, both in the region and beyond.

The most pervasive conflict arises from the fact that disadvantaged rural communities in the region exist in an abundance of immensely valuable water resources but receive very little compensation (i.e., more disadvantaged communities have fewer resources to pursue grant funding, or the grants are geared towards more urbanized areas). Flood control, electrical power generation, agriculture, urban development, recreation on foothill reservoirs and Central Valley rivers, and environmental uses in the Central Valley and Bay/Delta--all beneficial uses of the region's area water--are primarily or entirely directed by entities outside of the watershed. Management of water in the region for maintenance of these outside-the-region beneficial uses of water can conflict with economic, social, beneficial uses of water within the region, and cultural development needs within the region as well.

Competing needs and uses within the region include agricultural, municipal, residential using private wells, hydroelectric, and environmental water uses. Agriculture is the largest consumptive use of water in the watershed, and in dry years increasingly relies on groundwater pumping. Groundwater overdraft during prolonged droughts could cause conflicts between competing water uses if farms and municipalities and environmental needs are reliant on the same aquifer. If lowered water tables affect stream flows or riparian habitat, environmental and economic needs are pitted against each other. Irrigation for hay crops in the Sierra Valley resulted in significant groundwater pumping, which has steadily increased from approximately 7,500 acre-feet in 2001 to 13,117 acre-feet in 2015. The Sierra Valley Groundwater Management District Technical Reports identify a safe groundwater basin yield of 6,000 acre-feet. Ranching is an important economic activity as well as a cultural tradition in the watershed. However, in some areas within the region historic sheep and cattle grazing in meadows and uplands resulted in impacts to wetlands, streams, vegetation, and soils, and decreases in water quality from streambank erosion. Restoration projects today usually include investments in riparian and pasture fencing and the development of off-stream water for improved grazing management and forage production. The reintroduction and management of beaver is becoming a more accepted aspect of watershed rehabilitation and is being included in irrigation, floodway, and roadway infrastructure improvement designs.

Dams on the region's rivers constructed for hydroelectricity and water management have caused the extirpation of salmon above Oroville Dam. Salmon are an important part of local Native American culture and traditional lifeways. Restoring salmon to the Upper Feather River would require modification of water management and infrastructure for hydroelectric production as well as substantial restoration of upper watershed streams that would need investments for compatibility with land and water management infrastructure and uses.

Environmental water uses involve stream flow levels necessary to maintain aquatic, wetland, and riparian habitats as well as aesthetic values. The Middle Fork of the Feather River between Mohawk Valley and Lake Oroville has been designated a Wild and Scenic River. The headwaters of the Middle Fork are in Sierra Valley, which is the largest agricultural area in the watershed with over 40,000 acres of irrigated farmland and includes the two incorporated cities in the region. Consumptive water uses in Sierra Valley and Mohawk Valley could conflict with flow needs in the downstream Wild and Scenic reach of the Middle Fork if current water demands or conditions change.

Hydroelectric uses often result in conflicts over how the timing of water releases affects recreation, water temperature, and sensitive species habitat in downstream rivers. Over the past 15 years, FERC relicensing has been controversial at Rock Creek, South Feather, Oroville, Lake Almanor, and Poe because of issues related to water temperature, recreation, species habitat, and changing runoff patterns.

Other conflicts in the watershed arise from land management practices. The vast majority of the watershed is forested uplands, and past management of those lands has resulted in substantial conflicts including water resource issues. Past mining and logging activities have left a legacy of toxic pollution from tailings and a large number of legacy and poorly maintained roads that are susceptible to erosion. Logging has declined since the late 1980s which has exacerbated the buildup of fuels and increasing forest densities, impairing forest health, all of which can affect the quantity and quality of surface and ground water in a variety of ways. The most important forest management strategies for watershed improvement are stand thinning and road restoration. However, these activities are uneconomic, controversial and frequently opposed. Conflicts over closures of forest roads will continue when roads are developed for emergency firefighting access.

Meadow restoration projects also can create conflicts with downstream water users. Many meadows in the watershed have become degraded. As streams become disconnected from their floodplains, formerly wet meadows transition to dry shrub lands, and groundwater recharge and flood attenuation functions are impaired. Meadow restoration can have long-term benefits to the entire watershed, but depending on site characteristics and restoration designs, reversing meadow degradation can result in temporary or long-term reductions in nearby stream flows as aquifers refill with water, and groundwater recharge absorbs a greater percentage of surface water that downstream water users rely upon for their water needs.

CHAPTER 5.0 GOALS AND OBJECTIVES

5.1 Introduction

This chapter addresses the Integrated Regional Water Management (IRWM) Objectives Plan standard that requires IRWM plans to:

- Present plan objectives, which must address major water-related issues and conflicts of the Region and must be measurable by some practical means so achievement of objectives can be monitored.
- Describe the process used to develop the objectives.
- Contain an explanation of the prioritization or reason why the objectives are not prioritized.
- Consider climate change.

5.2 Development of Goals and Objectives

Goals and objectives provide focus for an IRWM plan, and guide selection of resource management strategies, project development and selection, and development of implementation and performance measures. The goals and objectives presented in this section represent the foundational intent of this IRWM Plan to guide and improve water resources management throughout the Region over the planning horizon of the next 20 years, to 2035.

5.2.1 Process for developing Goals and Objectives

5.2.1.1 Development of goals and objectives for the IRWM Plan

To initiate the process, the Regional Water Management Group (RWMG) reviewed the 2005 Upper Feather River (UFR) IRWM Plan's goals and objectives for current regional relevancy. The RWMG's development of draft goals and objectives occurred during public meetings held on January 28 and March 27, 2015. In developing draft goals and objectives, the RWMG also reviewed and considered regionally relevant objectives contained within the California Water Code § 10540(c), the Sacramento River Basin Plan, and objectives developed by other IRWM regions. Ultimately five draft goals and 18 draft objectives were developed which were then discussed at length within the workgroups and Tribal Advisory Committee (TAC) by participants throughout the Region. The workgroups and TAC each held public meetings during which the draft objectives were reviewed and comments and recommendations drafted for the RWMG's consideration.

Workgroups formed at the beginning of the Plan Update process held focused discussions on the draft objectives for their respective areas of long-term interest within the Upper Feather River watershed: (1) agricultural land stewardship; (2) floodplains, meadow, and waterbodies management, (3) municipal services, and; (4) uplands and forest management. Workgroups are made up of stakeholders and interested persons from throughout the Region; public participation in all meetings is highly encouraged. Following acceptance of the final Plan objectives, the RWMG crafted five overarching Plan goals to encompass water, land, people, and wildlife. The RWMG approved the final Plan goals and objectives during its March 27, 2015 public meeting.

5.2.1.2 2005 UFR IRWM Plan

The 2005 Upper Feather River IRWM Plan included seven goals and 12 objectives based on California Water Code requirements, Sacramento River Basin Plan objectives, California Water Plan guidance, and regional issues current at the time. Subsequent changes to California Water Code and the Basin Plan, as well as Proposition 84 and the 2013 update to the California Water Plan, have added new requirements for regional IRWM plans.

The draft IRWM Plan represents an update and extension of the existing 2005 Plan, retaining the goals and objectives in the 2005 Plan and including additional goals and objectives based on new requirements.

Overall, the goals and objectives of this IRWM Plan are broader than those of the 2005 Plan, which emphasized water quality and upland watershed management. The goals and objectives of this Plan focus on water quality and watershed health while also emphasizing water and wastewater services, adaptation to climate change, economic and social health of communities, capacity building, and stakeholder outreach and engagement.

5.2.2 Prioritization of Goals and Objectives

During its March 27, 2015 public meeting, the RWMG unanimously agreed not to prioritize Plan objectives, determining that all of the objectives had equal weight, and that to prioritize them would limit the potential breadth of stakeholder interests and involvement, and ultimately support for the full potential for integrated water management.

5.3 Goals, Objectives and Performance Metrics

5.3.1 Goals and Objectives

The RWMG adopted five goals and 18 objectives for management of regional water resources in the Upper Feather River Watershed for the IRWM Plan. The five goals of the Plan are to

- Protect and improve water quality and water supply reliability.
- Protect and improve the health of the environment.
- Protect and improve the economy of the Region and provide water and wastewater treatment services to all citizens.
- Establish and maintain effective communication among water and resource stakeholders in the Region.
- Protect and enhance the economic viability of the working landscapes of the Region.

The 18 Plan objectives are more detailed, process-oriented actions focused on the specific concerns of stakeholders, and the environmental, economic, social, and cultural conditions in the Plan area. The 18 Plan objectives are:

- Restore natural hydrologic functions.
- Reduce potential for catastrophic wildland fires in the Region.
- Balance the needs of forest health, habitat preservation, fuels reduction, forest fire prevention, and economic activity in the Upper Feather River Region.
- Build communication and collaboration among water resources stakeholders in the Region.
- Work with the Department of Water Resources to develop strategies and actions for the management, operation, and control of State Water Project facilities in the Upper Feather River Watershed in order to increase water supply, recreational, and environmental benefits to the Region.
- Encourage municipal service providers to participate in regional water management actions that improve water supply and water quality.

- Continue to actively engage in Federal Energy Regulatory Commission (FERC) relicensing of hydroelectric facilities in the Region.
- Address economic challenges of municipal service providers to serve customers.
- Protect, restore, and enhance the quality of surface and groundwater resources for all beneficial uses, consistent with the Basin Plan.
- Address water resources and wastewater needs of Disadvantaged Communities (DACs) and Native Americans.
- Coordinate management of recharge areas and protect groundwater resources.
- Improve coordination of land use and water resources planning.
- Maximize agricultural, environmental and municipal water use efficiency.
- Effectively address climate change adaptation and/or mitigation in water resources management.
- Improve efficiency and reliability of water supply and other water-related infrastructure.
- Enhance public awareness and understanding of water management issues and needs.
- Address economic challenges of agricultural producers.
- Work with counties/communities/groups to make sure staff capacity exists for actual administration and implementation of grant funding.

5.3.2 Performance Metrics

Plan performance will be assessed in terms of progress toward achieving the Plan objectives. As described in Chapter 10 – *Impacts and Benefits*, the objectives of the Plan generally represent the intended benefits of Plan implementation, and include both plan-level and project-level benefits. Evaluation of Plan performance will include an assessment of the extent to which plan-level benefits have been realized through Plan implementation. Assessment of project-level benefits will be incorporated into individual project monitoring plans. Monitoring Plan performance will be closely tied to the implementation of individual projects, and the IRWM Plan focuses on establishing a framework for evaluation that will link project completion to IRWM Plan implementation. See Chapter 11 – *Plan Implementation, Performance, Monitoring and Data Management* for a detailed discussion of Plan performance metrics.

5.4 Plan Integration of Goals and Objectives

5.4.1 Regional Issues

Goals and objectives of the Plan were formulated in response to the regional issues identified by the workgroups and TAC, as well as the requirements of the California Water Code, California Water Plan, Propositions 84 and 1, and the Sacramento River Basin Water Quality Control Plan. Each regional issue identified by the workgroups was linked to at least one Plan objective (Tables 5-1, 5-2, 5-3, and 5-4).

Table 5-1. Agricultural Lands Stewardship Workgroup Issues and Plan Objectives

UFR IWRM Objectives	Issues identified by the Agricultural Lands Stewardship Workgroup															
	Lack of consistent supply of surface & ground H20	Water-Demand vs Supply-Competing/Historical Uses	Climate Change: Snow pack-precipitation, temperature	Regulatory costs (time, money, leadership)	Conveyance System Infrastructure	Clarification of Water Rights & Decrees	Groundwater Basin Recharge	Surface Water Storage	Management of Upland Forests-Evapotranspiration/Storage	Irrigation Management	Water Quality Management (nutrient, sediment, pathogen, etc.)	Holistic Management (soil health/forage mixes, etc.)	Availability of Public/Private Grazing Lands	Collaboration between Interests, (e.g., treated muni water for irrigation)	Capacity of individuals and groups in Ag Community	Wildlife/Habitat Enhancement
Restore natural hydrologic functions.	X		X				X		X							
Reduce potential for catastrophic wildland fires in the Region.			X					X					X			
Balance the needs of forest health, habitat preservation, fuels reduction, forest fire prevention, and economic activity in the Upper Feather River Region.	X	X	X	X	X		X	X	X	X	X	X			X	X
Build communication and collaboration among water resources stakeholders in the Region.		X		X		X				X			X	X	X	
Work with the Department of Water Resources to develop strategies and actions for the management, operation, and control of State Water Project facilities in the Upper Feather River	X	X		X	X	X		X		X						

UFR IWRM Objectives	Issues identified by the Agricultural Lands Stewardship Workgroup															
	Lack of consistent supply of surface & ground H20	Water-Demand vs Supply-Competing/Historical Uses	Climate Change: Snow pack-precipitation, temperature	Regulatory costs (time, money, leadership)	Conveyance System Infrastructure	Clarification of Water Rights & Decrees	Groundwater Basin Recharge	Surface Water Storage	Management of Upland Forests-Evapotranspiration/Storage	Irrigation Management	Water Quality Management (nutrient, sediment, pathogen, etc.)	Holistic Management (soil health/forage mixes, etc.)	Availability of Public/Private Grazing Lands	Collaboration between Interests, (e.g., treated muni water for irrigation)	Capacity of individuals and groups in Ag Community	Wildlife/Habitat Enhancement
Watershed in order to increase water supply, recreational and environmental benefits to the Region.																
Encourage municipal service providers to participate in regional water management actions that improve water supply and water quality.	X	X					X							X		
Continue to actively engage in Federal Energy Regulatory Commission (FERC) relicensing of hydroelectric facilities in the Region.																
Address economic challenges of municipal service providers to serve customers.														X		
Protect, restore, and enhance the quality of surface and groundwater resources for all beneficial uses, consistent with the Basin Plan.							X	X	X							X

	Issues identified by the Agricultural Lands Stewardship Workgroup															
UFR IWRM Objectives	**Lack of consistent supply of surface & ground H20**	**Water-Demand vs Supply-Competing/Historical Uses**	**Climate Change: Snow pack-precipitation, temperature**	**Regulatory costs (time, money, leadership)**	**Conveyance System Infrastructure**	**Clarification of Water Rights & Decrees**	**Groundwater Basin Recharge**	**Surface Water Storage**	**Management of Upland Forests-Evapotranspiration/Storage**	**Irrigation Management**	**Water Quality Management (nutrient, sediment, pathogen, etc.)**	**Holistic Management (soil health/forage mixes, etc.)**	**Availability of Public/Private Grazing Lands**	**Collaboration between Interests, (e.g., treated muni water for irrigation)**	**Capacity of individuals and groups in Ag Community**	**Wildlife/Habitat Enhancement**
Address water resources and wastewater needs of Disadvantaged Communities (DACs) and Native Americans.														X		
Coordinate management of recharge areas and protect groundwater resources.	X	X		X			X							X	X	
Balance management of recharge areas for all users including agriculture, municipal and environmental resource needs.	X	X		X	X		X							X	X	X
Improve coordination of land use and water resources planning. (CWP)	X	X		X	X	X	X	X	X	X	X	X	X	X	X	
Maximize agricultural, environmental and municipal water use efficiency.	X	X	X	X	X		X	X	X	X				X	X	
Effectively address climate change adaptation and/or mitigation in water resources management.	X	X	X									X				

	Issues identified by the Agricultural Lands Stewardship Workgroup															
UFR IWRM Objectives	**Lack of consistent supply of surface & ground H20**	**Water-Demand vs Supply-Competing/Historical Uses**	**Climate Change: Snow pack-precipitation, temperature**	**Regulatory costs (time, money, leadership)**	**Conveyance System Infrastructure**	**Clarification of Water Rights & Decrees**	**Groundwater Basin Recharge**	**Surface Water Storage**	**Management of Upland Forests-Evapotranspiration/Storage**	**Irrigation Management**	**Water Quality Management (nutrient, sediment, pathogen, etc.)**	**Holistic Management (soil health/forage mixes, etc.)**	**Availability of Public/Private Grazing Lands**	**Collaboration between Interests, (e.g., treated muni water for irrigation)**	**Capacity of individuals and groups in Ag Community**	**Wildlife/Habitat Enhancement**
Improve efficiency and reliability of water supply and other water-related infrastructure.	X	X	X	X	X	X	X	X	X					X	X	X
Enhance public awareness and understanding of water management issues and needs.	X	X	X			X									X	X
Address economic challenges of agricultural producers.	X	X		X	X					X					X	X
Work with counties/communities/groups to make sure staff capacity exists for actual administration and implementation of grant funding.														X	X	

Table 5-2. Floodplains, Meadows, and Waterbodies Workgroup Issues and Plan Objectives

	Issues identified by the Floodplains, Meadows, and Waterbodies Workgroup																			
UFR IRWM Objectives	**Water Quality**	**Water Quantity**	**Fisheries Habitat**	**Grazing on public lands**	**Degraded Meadows**	**Wildfire Impacts**	**Waterbodies-sediments**	**Conifer Encroachment**	**Water Storage/Release - Impoundments**	**Flood Management - Timing**	**Preserving Floodplains**	**Extending Stream Flow – Water release**	**Improve Wildlife Habitat**	**Improve Recreation Facilities**	**Sediment Management**	**Abandoned mines impacts**	**Salmon – Middle Fork**	**Integration of Programs**	**Better Collaboration btn agencies & people**	**Threatened & Endangered Species**
Restore natural hydrologic functions.	X	X	X		X		X			X	X	X			X			X	X	
Reduce potential for catastrophic wildland fires in the Region.																				
Balance the needs of forest health, habitat preservation, fuels reduction, forest fire prevention, and economic activity in the Upper Feather River Region.																				
Build communication and collaboration among water resources stakeholders in the Region.																		X	X	
Work with the Department of Water Resources to develop strategies and actions for the management, operation, and control of State Water Project facilities in the Upper Feather River Watershed in order to increase water supply, recreational and environmental benefits to the Region.		X							X					X					X	
Encourage municipal service providers_to participate in regional water management actions that improve water supply and water quality.																				

	Issues identified by the Floodplains, Meadows, and Waterbodies Workgroup																			
UFR IRWM Objectives	**Water Quality**	**Water Quantity**	**Fisheries Habitat**	**Grazing on public lands**	**Degraded Meadows**	**Wildfire Impacts**	**Waterbodies-sediments**	**Conifer Encroachment**	**Water Storage/Release - Impoundments**	**Flood Management - Timing**	**Preserving Floodplains**	**Extending Stream Flow – Water release**	**Improve Wildlife Habitat**	**Improve Recreation Facilities**	**Sediment Management**	**Abandoned mines impacts**	**Salmon – Middle Fork**	**Integration of Programs**	**Better Collaboration btn agencies & people**	**Threatened & Endangered Species**
Continue to actively engage in Federal Energy Regulatory Commission (FERC) relicensing of hydroelectric facilities in the Region.	X	X	X				X		X	X		X					X		X	
Address economic challenges of municipal service providers to serve customers.																				
Protect, restore, and enhance the quality of surface and groundwater resources for all beneficial uses, consistent with the Basin Plan.	X	X	X		X		X				X				X	X		X	X	
Address water resources and wastewater needs of Disadvantaged Communities (DACs) and Native Americans.																				
Coordinate management of recharge areas and protect groundwater resources.																		X	X	
Improve coordination of land use and water resources planning.																		X	X	
Maximize agricultural, environmental and municipal water use efficiency.		X			X			X										X	X	

	Issues identified by the Floodplains, Meadows, and Waterbodies Workgroup																			
UFR IRWM Objectives	**Water Quality**	**Water Quantity**	**Fisheries Habitat**	**Grazing on public lands**	**Degraded Meadows**	**Wildfire Impacts**	**Waterbodies-sediments**	**Conifer Encroachment**	**Water Storage/Release - Impoundments**	**Flood Management - Timing**	**Preserving Floodplains**	**Extending Stream Flow – Water release**	**Improve Wildlife Habitat**	**Improve Recreation Facilities**	**Sediment Management**	**Abandoned mines impacts**	**Salmon – Middle Fork**	**Integration of Programs**	**Better Collaboration btn agencies & people**	**Threatened & Endangered Species**
Effectively address climate change adaptation and/or mitigation in water resources management.																		X	X	
Improve efficiency and reliability of water supply and other water-related infrastructure.									X			X							X	
Enhance public awareness and understanding of water management issues and needs.																			X	
Address economic challenges of agricultural producers.																				
Work with counties/communities/groups to make sure staff capacity exists for actual administration and implementation of grant funding.																			X	

Table 5-3. Municipal Services Workgroup Issues and Plan Objectives

UFR IRWM Objectives	Issues identified by the Municipal Services Workgroup															
	Water Quality	Wastewater Reuse	Infiltration/ Inflow	Inadequate Storage	Aging infrastructure	Regulatory Requirements	Wastewater pond/levee integrity	Regional Facilities	Dam/reservoir integrity	Reservoir capacity loss	Insufficient O&M Revenue	Limited staff and budget	Insufficient flow capacity	Location of private wells	Staff training	Flood Management
Restore natural hydrologic functions.			X						X	X			X			
Reduce potential for catastrophic wildland fires in the Region.				X	X							X		X		
Balance the needs of forest health, habitat preservation, fuels reduction, forest fire prevention, and economic activity in the Upper Feather River Region.																
Build communication and collaboration among water resources stakeholders in the Region.	X	X				X									X	
Work with the Department of Water Resources to develop strategies and actions for the management, operation, and control of State Water Project facilities in the Upper Feather River Watershed in order to increase water supply, recreational and environmental benefits to the Region.	X					X			X	X					X	X
Encourage municipal service providers_to participate in regional water management actions that improve water supply and water quality.	X	X	X			X		X				X			X	
Continue to actively engage in Federal Energy Regulatory Commission (FERC) relicensing of hydroelectric facilities in the Region.																
Address economic challenges of municipal service providers to serve customers.	X	X	X	X	X	X						X			X	
Protect, restore, and enhance the quality of surface and groundwater resources for all beneficial uses, consistent with the Basin Plan.	X	X			X	X	X	X	X	X	X	X		X	X	

UFR IRWM Objectives	Issues identified by the Municipal Services Workgroup															
	Water Quality	Wastewater Reuse	Infiltration/ Inflow	Inadequate Storage	Aging infrastructure	Regulatory Requirements	Wastewater pond/levee integrity	Regional Facilities	Dam/reservoir integrity	Reservoir capacity loss	Insufficient O&M Revenue	Limited staff and budget	Insufficient flow capacity	Location of private wells	Staff training	Flood Management
Address water resources and wastewater needs of Disadvantaged Communities (DACs) and Native Americans.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Coordinate management of recharge areas and protect groundwater resources.	X	X	X			X								X	X	
Improve coordination of land use and water resources planning.	X	X						X	X			X		X	X	X
Maximize agricultural, environmental and municipal water use efficiency.		X			X	X			X					X		
Effectively address climate change adaptation and/or mitigation in water resources management.	X	X		X	X					X				X		X
Improve efficiency and reliability of water supply and other water-related infrastructure.	X	X	X	X	X				X	X	X		X	X	X	
Enhance public awareness and understanding of water management issues and needs.	X	X		X		X	X		X	X		X			X	X
Address economic challenges of agricultural producers.		X								X				X		
Work with counties/communities/groups to make sure staff capacity exists for actual administration and implementation of grant funding.												X			X	

Table 5-4. Uplands and Forests Workgroup Issues and Plan Objectives

UFR IRWM Objectives	Issues identified by the Uplands and Forest Workgroup													
	Soil impacts	Loss of riparian forests	Infiltration/ Inflow changes	Conversion of forests to brush	Los of critical habitats	Post burn rehabilitation	Active biomass infrastructure is Inadequate	Regional wood processing facilities	Conifer encroachment into meadows	Groundwater infiltration & soil	Fire liability	Increasing stand densities & ET	Role of applied science & data:	Water for fire & forest management
Restore natural hydrologic functions.	X	X	X	X	X	X			X	X		X	X	
Reduce potential for catastrophic wildland fires in the Region in order to improve watershed conditions for downstream benefits and beneficiaries.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Balance and integrate the needs of forest health, water supply and quality, habitat preservation, fuels reduction, forest fire prevention, and economic activity in the Upper Feather River Region.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Build communication and collaboration among water resources stakeholders in the Region.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Work with the Department of Water Resources to develop strategies and actions for the management, operation, and control of State Water Project facilities in the Upper Feather River Watershed in order to increase water supply, recreational and environmental benefits to the region & for California	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Encourage municipal service providers_to participate in regional water management actions that improve water supply and water quality.											X			X
Continue to actively engage in Federal Energy Regulatory Commission (FERC) relicensing of hydroelectric facilities in the Region.			X										X	X
Address economic challenges of municipal service providers to serve customers.											X			X

UFR IRWM Objectives	Issues identified by the Uplands and Forest Workgroup													
	Soil impacts	Loss of riparian forests	Infiltration/ Inflow changes	Conversion of forests to brush	Los of critical habitats	Post burn rehabilitation	Active biomass infrastructure is Inadequate	Regional wood processing facilities	Conifer encroachment into meadows	Groundwater infiltration & soil	Fire liability	Increasing stand densities & ET	Role of applied science & data:	Water for fire & forest management
Protect, restore, and enhance the quality of surface and groundwater resources for all beneficial uses, consistent with the Basin Plan.	X	X	X	X	X	X			X	X	X	X	X	
Address water resources and wastewater needs of Disadvantaged Communities (DACs) and Native Americans.			X										X	X
Coordinate management of upland recharge areas and protect and enhance groundwater storage.	X	X	X	X	X	X			X	X		X	X	
Improve coordination of land use and water resources planning.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Maximize agricultural, environmental and municipal water use efficiency.													X	X
Effectively address climate change adaptation and/or mitigation in water resources management.	X	X		X	X	X	X	X	X	X	X	X	X	X
Improve efficiency and reliability of water supply and other water-related infrastructure.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Enhance public awareness and understanding of water management issues and needs.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Address economic challenges of agricultural & forest product producers.							X	X			X			X
Work with counties/communities/groups to make sure staff capacity exists for actual administration and implementation of grant funding.	X	X	X	X	X	X	X	X	X	X	X	X	X	X

5.4.2 Resource Management Strategies

The draft *California Water Plan Update 2013* presents 30 standard resource management strategies (RMS) designed to help meet the water-related goals and objectives of IRWM plans across the state. An RMS is a technique, program, or policy that helps local entities manage their water and water-related resources. The intent of the RMS standard is to encourage diversification of water management approaches as a way to mitigate for uncertain future circumstances, rather than relying on a single strategy or approach for addressing a regional issue.

An IRWM Plan must consider, at a minimum, each RMS in the *California Water Plan Update 2013*; additional RMSs can be formulated as well in response to regional conditions. All 30 standard RMSs were considered in formulating the current Plan; however, three were inapplicable to the Plan area and the workgroups did not make specific strategy recommendations for these three RMSs. Workgroups and the TAC identified strategy recommendations tailored to the specific goals and objectives of the Plan for each of the 27 standard RMSs considered. The relationship between the IRWM Plan objectives and the 27 standard RMSs considered is summarized in Table 5-5.

The RMSs discussed in this chapter will be incorporated into the process for development and review of individual projects under the IRWM Plan. Please see Chapter 9 – *Project Development and Review Process* for a detailed description of the timing and review process for individual projects.

Table 5-5. Plan Objectives and Resource Management Strategies

UFR IRWM Objectives	Resource Management Strategies
Restore natural hydrologic functions	Flood control Surface storage – Regional Ecosystem restoration Recharge area protection Watershed management
Reduce potential for catastrophic wildland fires in the Region	Ecosystem restoration Forest management
Balance the needs of forest health, habitat preservation, fuels reduction, forest fire prevention, and economic activity in the Upper Feather River Region	Forest management
Build communication and collaboration among water resources stakeholders in the Region	Conjunctive management Outreach and engagement
Work with the Department of Water Resources to develop strategies and actions for the management, operation, and control of State Water Project facilities in the Upper Feather River Watershed in order to increase water supply, recreational and environmental benefits to the Region	Conjunctive management
Encourage municipal service providers to participate in regional water management actions that improve water supply and water quality	Outreach and engagement
Continue to actively engage in Federal Energy Regulatory Commission (FERC) relicensing of hydroelectric facilities in the Region	Conjunctive management

UFR IRWM Objectives	Resource Management Strategies
Address economic challenges of municipal service providers to serve customers	Drinking water treatment and distribution Wastewater/NPDES
Protect, restore, and enhance the quality of surface and groundwater resources for all beneficial uses, consistent with the Basin Plan	Flood management Conveyance – Regional Pollution prevention Ecosystem restoration Recharge area protection Sediment management Watershed management
Address water resources and wastewater needs of Disadvantaged Communities (DACs) and Native Americans	Drinking water treatment and distribution Wastewater/NPDES
Coordinate management of recharge areas and protect groundwater resources	Conjunctive management Recharge area protection Watershed management
Improve coordination of land use and water resources planning	Land use planning and management Agricultural land stewardship
Maximize agricultural, environmental and municipal water use efficiency	Conjunctive management Surface storage – Regional Ecosystem restoration Recharge area protection
Effectively address climate change adaptation and/or mitigation in water resources management	Conjunctive management Ecosystem restoration Watershed management
Improve efficiency and reliability of water supply and other water-related infrastructure	Conveyance –Regional/Local Surface storage – Regional/Local
Enhance public awareness and understanding of water management issues and needs	Ecosystem restoration Watershed management Outreach and engagement
Address economic challenges of agricultural producers	Agricultural land stewardship Economic incentives
Work with counties/communities/groups to make sure staff capacity exists for actual administration and implementation of grant funding	Outreach and engagement

5.4.3 Implementation Projects

Table 5-6 presents the Plan objectives and implementing projects.

Table 5-6 Plan Objectives and Implementing Projects

Project Number/Title	Objectives [a]																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
ALS-1:Taylorsville Mill Race Dam resurfacing		X		X					X		X	X	X	X	X	X	X	X
ALS-2: Water quality and infrastructure upgrades on working lands	X		X	X	X				X		X	X	X	X	X	X	X	X
ALS-3: Enhanced management of livestock grazing	X		X	X		X			X		X	X	X	X	X		X	X
ALS-4: Invasive weed management	X	X	X	X					X			X	X	X		X	X	X
ALS-6: Sierra Valley agricultural water diversion efficiency and improvements	X		X	X					X			X	X	X	X	X	X	X
ALS-7: Sierra Valley Resource Conservation District Resource Management Plan	X	X	X	X	X				X		X	X	X	X	X	X	X	X
ALS-8: Upper Feather River weather monitoring infrastructure		X		X		X			X		X	X	X	X	X	X	X	
ALS-9: Soil health assessment	X		X	X					X	X	X	X	X	X		X	X	X
ALS-10: Sierra Valley Groundwater Sustainability Plan	X		X	X		X			X		X	X	X	X	X	X	X	X
ALS-11: Cold Stream agricultural and fire storage Impoundment		X		X	X				X		X	X	X	X	X	X	X	X
ALS-12: Alfalfa alternative			X	X					X		X	X	X	X	X		X	X
ALS-13: Little Last Chance Lake	X			X	X				X		X	X	X	X	X	X	X	X
FMW-2: Water quality monitoring program for Lake Almanor and its tributaries			X	X	X		X					X		X		X		
FMW-4: Wildlife enhancement project	X		X	X	X				X								X	
FMW-5: Upper Feather River interpretive and education sites			X											X		X		
FMW-6: Watershed monitoring program			X	X		X						X				X		
FMW-8: Spanish Creek restoration	X											X						
FMW-9: Watershed education			X													X		
FMW-10: Lake Almanor Basin stewardship and outreach program			X	X	X		X		X					X		X		X
FMW-11: Lake Almanor Basin water quality improvement plan			X	X	X	X	X					X		X	X	X		X
FMW-14: Folchi Meadow project	X	X	X	X					X					X				X

Project Number/Title	Objectives [a]																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
FMW-15: Fish habitat assessment/restoration, public awareness/education			X	X	X				X					X		X		
FMW-16: Fish distribution modeling in relation to climate change	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X	
FMW-18: Mountain Meadows livestock fencing	X		X						X									
FMW-19: Debris dam survey, inventory and characterization			X		X				X		X			X		X		
MS-1: Wastewater system infrastructure improvements				X	X	X		X	X	X	X				X	X		X
MS-2: Turner Springs improvement		X			X			X		X		X		X	X			X
MS-4: Water tank project		X				X		X	X	X	X		X	X	X			X
MS-6: Old Mill Ranch				X		X		X	X	X	X		X	X	X			X
MS-7: High elevation water tank and well	X	X		X		X		X	X	X	X	X	X	X	X			X
MS-8: Water reclamation facility	X	X		X		X		X	X	X	X	X	X	X	X			X
MS-9: Crocker water service meters						X		X	X	X	X		X	X	X			X
MS-10: Crocker Welch ground tank repair						X		X	X	X	X		X	X	X			X
MS-11: Delleker water meters						X		X	X	X	X		X	X	X			X
MS-12: Delleker water tank rehabilitation						X		X		X	X		X		X			X
MS-13: Groundwater monitoring				X		X				X	X	X			X	X		X
MS-15: Chandler Road bridge erosion	X								X									X
MS-16: Humbug Valley Road bridge erosion									X									X
MS-17: Road 311 culvert improvement									X									X
MS-18: Road 318 culvert improvement									X									X
MS-19: North Valley Road bridge erosion	X								X									X
MS-20: Mill Creek erosion	X								X									X
MS-21: Smith Creek erosion	X								X									X
MS-22: Wapaunsie Creek erosion	X								X									X
MS-23: Stampfli Land bridge erosion	X								X									X
MS-24: Walker Ranch Community Services District infrastructure improvements													X	X				X
MS-25: Humbug Valley Road 307 culvert improvement									X									X

Project Number/Title	Objectives [a]																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
MS-26: Municipal well No. 3		X				X		X	X						X			X
MS-27: Treated wastewater reuse	X	X		X		X				X	X	X	X	X	X	X	X	X
MS-28: Water meter installation						X		X							X	X		X
MS-29: Water storage tank replacement		X				X					X			X	X			X
MS-30: Wastewater treatment plant No. 6 upgrade						X			X						X			X
MS-31: Wastewater treatment plant No. 7 lift station replacement						X		X	X									X
MS-32: Water system improvements		X				X		X	X	X			X	X	X	X		X
MS-33: Sierra County road improvements	X			X					X		X	X						X
MS-35: Alternative water storage analysis and development	X			X					X		X	X						X
MS-36: Water storage project		X				X		X		X			X		X	X		
MS-37: Almanor Basin solid and wastewater treatment plant				X	X	X	X	X	X	X	X	X		X		X		X
MS-38: Leak detection and repair		X		X	X	X		X	X	X			X		X	X		X
MS-39: Meter replacement						X		X		X		X	X		X	X		X
MS-40: Pumphouse improvement		X		X	X	X		X		X			X		X	X		X
MS-41: Tank replacement project		X		X	X	X		X	X	X		X	X	X	X	X		X
MS-42: Automatic meter reading project		X		X	X	X		X	X	X	X		X		X	X		
MS-43: Replace copper service lines project		X				X		X	X	X	X		X		X			X
TAC-2: Big Springs vegetation management	X	X	X	X	X	X	X		X	X		X		X		X		X
TAC-3: Mud Creek habitat recovery	X	X	X	X					X	X		X				X		X
TAC-5: Indian Jim River Resource Center	X		X	X			X		X			X			X	X		X
TAC-6: Tradition Ecological Knowledge	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
UF-1: Marian Meadow	X	X	X	X					X		X			X		X		
UF-2: Rock Creek meadow restoration	X	X	X	X					X		X	X		X	X	X		
UF-6: Round Valley/Keddie hand thin	X	X	X	X					X	X		X		X	X			X
UF-7: US Forest Service road improvements	X	X	X	X	X				X	X		X		X		X		X
UF-8: Goodrich Creek biomass	X	X	X			X			X									
UF-10: Greenville Creek biomass	X	X	X			X			X									
UF-11: Mountain Meadows Creek biomass	X	X	X			X			X									

Project Number/Title	Objectives [a]																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
UF-12: Upper Feather River cooperative regional thinning	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X
UF-13: Upper Feather River cooperative LiDAR and GIS support program	X	X	X	X	X		X		X	X	X	X	X	X		X	X	X

[a] Plan Objectives numbering is only for identification purposes and does not reflect priority objectives or projects

1: Restore natural hydrologic functions

2: Reduce potential for catastrophic wildland fires in the Region

3: Balance the needs of forest health, habitat preservation, fuels reduction, forest fire prevention, and economic activity in the Upper Feather River Region

4: Build communication and collaboration among water resources stakeholders in the region

5: Work with the Department of Water Resources to develop strategies and actions for the management, operation, and control of State Water Project facilities in the Upper Feather River Watershed in order to increase water supply, recreational and environmental benefits to the Region

6: Encourage municipal service providers to participate in regional water management actions that improve water supply and water quality

7: Continue to actively engage in Federal Energy Regulatory Commission (FERC) relicensing of hydroelectric facilities in the Region

8: Address economic challenges of municipal service providers to serve customers

9: Protect, restore, and enhance the quality of surface and groundwater resources for all beneficial uses, consistent with the Basin Plan

10: Address water resources and wastewater needs of Disadvantaged Communities (DACs) and Native Americans

11: Coordinate management of recharge areas and protect groundwater resources

12: Improve coordination of land use and water resources planning

13: Maximize agricultural, environmental and municipal water use efficiency

14: Effectively address climate change adaptation and/or mitigation in water resources management

15: Improve efficiency and reliability of water supply and other water-related infrastructure

16: Enhance public awareness and understanding of water management issues and needs

17: Address economic challenges of agricultural producers

18: Work with counties/communities/groups to make sure staff capacity exists for actual administration and implementation of grant funding 17:

5.5 Relationship of Plan Objectives to Climate Change

The Proposition 1 IRWM objectives standard requires IRWM plans to consider the potential effects of climate change in the formulation of plan objectives. The following Plan objective specifically addresses climate change in the Upper Feather River Region:

Effectively address climate change adaptation and/or mitigation in water resources management.

Per Proposition 1 Guidelines, IRWM plans are required to include the following five climate change adaptation and mitigation requirements. In addition to the Plan's climate change objective identified above, elements of other Plan objectives also address the required topics as discussed below:

1. **Address adapting to changes in the amount, intensity, timing, quality and variability of runoff and recharge.**

Changes in the amount and timing of precipitation, as well as shifts from snowfall to rain, are major issues in the Plan area (Chapter 4 – *Regional Water Issues*). These changes are expected to become more common and severe as the result of climate change. Decreasing total precipitation, and shifts toward more precipitation falling as rain, will reduce water storage as snowpack and infiltration for groundwater recharge within the UFR watershed, as well as reduce the availability of water in the Plan area and downstream during the summer dry season. This pattern is exacerbated by losses of natural water-holding functions in high-elevation wet meadows due to degraded environmental conditions.

Plan objectives intended to improve the ability of the UFR watershed to store and release water include restoring natural hydrologic functions in the watershed; reducing potential for catastrophic wildland fires; protecting and enhancing groundwater recharge areas; and maximizing agricultural, environmental, and municipal water use efficiency.

2. **Consider the effects of sea level rise (SLR) on water supply conditions and identify suitable adaptation measures.**

The Plan area is not coastal and would not be affected by sea level rise; therefore, this factor is not pertinent to the UFR Region.

3. **Reduce energy consumption, especially the energy embedded in water use, and ultimately reducing greenhouse gas (GHG) emissions.**

Water use infrastructure in the Plan area is predominantly small-scale, serving communities and municipalities of fewer than 1,000 customers. Consequently, the energy embedded in water use in the Plan area is small. The Plan objectives include an objective to improve efficiency and reliability of water supply and other water-related infrastructure, which will improve the efficiency of water services in the Plan area and reduce energy consumption associated with water use.

The Plan area is a major producer of hydroelectric power, which contributes to California's statewide goal of reducing GHG emissions. Plan objectives include an objective to continue to actively engage in Federal Energy Regulatory Commission's (FERC) relicensing of hydroelectric facilities in the Region.

4. Consider, where practical, the strategies adopted by California Air Resources Board (CARB) in its AB 32 Scoping Plan, when evaluating different ways to meet IRWM plan objectives.

The Global Warming Solutions Act of 2006 (Assembly Bill 32) authorized the CARB to develop a scoping plan that includes 18 strategies for reducing carbon emissions statewide. Two of these--Sustainable Forests and Water--relate directly to the objectives of the IRWM Plan. The IRWM Plan objectives relating to sustainable forests include objectives to reduce the potential for catastrophic wildland fires, promote forest health, and develop forest biomass energy generation. The IRWM Plan objectives relating to energy use for water management include objectives to maximize water use efficiency and to encourage municipal service providers to participate in regional water management actions that improve water supply and water quality. Other scoping plan strategies may be incorporated into implementation projects, such as converting agency fleets to zero emission vehicles or installing rooftop solar on new and existing facilities.

5. Consider options for carbon sequestration and using renewable energy where such options are integrally tied to supporting IRWM Plan objectives.

Plan objectives include objectives to reduce the potential for catastrophic wildland fires, enhance groundwater recharge, and promote forest health and economic activity in the Plan area through stand-thinning and development of biomass energy production infrastructure. Improving forest health will enhance carbon sequestration by encouraging active stand regeneration, and biomass energy generation will contribute to statewide goals of reducing fossil fuel consumption. Additionally, there is a net benefit in avoiding the resultant release of stored carbon and especially "black carbon" during a catastrophic wildfire. Agriculture is also a major source of carbon sequestration, particularly when considering the native meadowlands and wetlands that are preserved and nurtured within the boundaries of many ranches within the Region. The Plan objective of engaging in FERC relicensing of hydroelectric facilities in the region will also contribute to statewide goals of reducing GHG emissions through the offset of carbon-based energy production.

CHAPTER 6.0 RESOURCE MANAGEMENT STRATEGIES

6.1 Introduction

The California Water Plan Update 2013 presents 30 standard resource management strategies (RMS) designed to help meet the water-related goals and objectives of integrated regional water management (IRWM) plans across the state. An RMS is a technique, program, or policy that helps local entities manage their water and water-related resources. The intent of the RMS standard is to encourage diversification of water management approaches as a way to mitigate for uncertain future circumstances, rather than relying on a single strategy or approach for addressing a regional issue. The RMSs are interrelated and each is to some extent dependent upon or complementary to others. Collectively, RMSs acknowledge that water management, whether within a single watershed or statewide, is a complex challenge that must balance environmental, societal, economic, and cultural drivers in order to maximize the beneficial uses of a finite and scarce resource. These strategies include considerations of assessed vulnerabilities and projected impacts of climate change on the region (please see Chapter 8 *Climate Change,* for a detailed discussion of climate change vulnerabilities and projected impacts on the region). RMS are grouped into categories based on the overall objectives of the California Water Plan:

- reduce demand;
- improve flood management;
- improve operational efficiency;
- increase water supply;
- improve water quality;
- practice resource stewardship; and
- recognize the connection between people and water.

An IRWM plan must consider, at a minimum, each RMS in the California Water Plan Update 2013 (DWR 2013c); additional RMSs can be formulated as well, in response to regional conditions. All 30 standard RMSs were considered in formulating the IRWM Plan; however, three were determined inapplicable to the Plan area. Additional strategies were formulated pertaining to fire and fuels management, wastewater treatment, snow fences, and rained agriculture. Workgoups identified strategy recommendations tailored to the specific goals and objectives of the Plan for each of the 27 standard RMSs considered. Please see Chapter 5 *Goals and Objectives* for a detailed discussion of the intended benefits of the Plan.

Sections 6.2 and 6.3 present a brief summary of each standard RMS; how it supports the region's climate change adaptation objectives; an assessment of its applicability to the Upper Feather River (UFR) IRWM Plan area; and a brief statement of the number and nature of recommendations made by workgroups, if applicable. Specific strategy recommendations from each of the workgroups for all applicable RMSs are located in Section 6.4 – *Strategy Recommendations*.

The RMSs discussed in this chapter are incorporated into the process for development and review of individual projects under the IRWM Plan. Please see Chapter 9 *Project Development and Review Process* for a detailed description of the timing and review process for individual projects.

6.2 Selected RMSs and Applicability to Region

The following standard RMS apply to the Upper Feather River IRWM Plan area.

6.2.1 Reduce Water Demand

Water conservation is defined by California Water Code (CWC) Section 10817 as "the efficient management of water resources for beneficial uses, preventing waste, or accomplishing additional benefits with the same amount of water." Thus, reduced water demand is not synonymous with water conservation, as increased efficiency can result from increases in benefits from the same amount of water, as well as from maintaining current levels of benefits from less water. In either case, increases in efficiency will tend to reduce waste and non-beneficial use of water resources, which will reduce present demand and/or allow for greater flexibility to meet future demand. Climate change has the potential to impact the volume and seasonal availability of water. As noted in Chapter 8 *Climate Change*, less precipitation and snowfall mean that current levels of water demand, if sustained, can stress the watershed and reduce the economic and environmental productivity of the region. Increasing efficiency of agricultural and urban water use could reduce demand, making the region more resilient to changes in precipitation patterns.

6.2.1.1 Agricultural Water Use Efficiency

The agricultural water use efficiency strategy describes the application of scientific processes to control agricultural water delivery and use, in order to achieve a beneficial outcome. It includes an estimation of net water savings or increased production resulting from implementing efficiency measures. Improvements in agricultural water use efficiency are expressed as yield improvements for a given unit amount of water, and can be estimated over individual fields or entire regions. The net water savings is the reduction in the amount of water applied, while maintaining or improving crop yield and agricultural productivity. Net water savings recognizes: 1) the uptake and transpiration of water for crop water use; 2) the role, benefits, and quantity of applied water that is recoverable and reusable in the agricultural setting; and 3) the quantity of irrecoverable applied water that flows to salt sinks--such as inaccessible or degraded saline aquifers--or that evaporates to the atmosphere and is unavailable for reuse.

Examples of measures that improve agricultural water use efficiency include:

- Hardware – improving irrigation and water delivery systems;
- Water management – reducing evapotranspiration and improving management of irrigation and water delivery systems; and
- Agricultural technology – breeding, genetically modified foods crops, fertilizers, technology, etc.

Currently, agricultural lands account for approximately 2.7 percent of the Plan area and are predominantly irrigated pasture rather than crops[1]. A reduction in agricultural water demand can minimize the impacts of existing vulnerabilities and help increase agricultural resiliency to possible decreases in water availability in the future. The Agricultural Lands Stewardship Workgroup identified 16 recommendations for promoting agricultural water use efficiency, including education, data sharing, and technical assistance to agricultural land managers, as well as the use of best management practices in agricultural operations (Table 6.1).

6.2.1.2 Urban Water Use Efficiency

Urban water use efficiency strategies focus on reducing demand, as most municipal water is not available for reuse without treatment. The California Water Plan Update 2013 includes 14 Demand Management Measures (DMMs) aimed at reducing urban water demand in California. These DMMs include internal water system audits, leak detection and repair, metering all connections and applying conservation

[1] Alfalfa and grass hay production are considered crops, as it can be harvested for sale and transport out of the area.

pricing, rebate programs for high-efficiency appliances, public outreach, and landscape surveys and water-efficient landscape guidelines.

Urban water use efficiency programs such as DMMs are targeted mainly at large urban water suppliers (CA Code 2016a), and produce significant savings at large scales. Municipal water in the region is supplied by small districts serving fewer than 3,000 customers; however, increasing efficiency of municipal water use would provide important benefits in the region, especially through reducing demands on existing infrastructure and avoiding the need for costly expansion. The region's population increases significantly in summer months with an influx of seasonal residents and tourism. Infrastructure that increases urban water use efficiency throughout the year can help preserve a limited water supply, even during times of increased water demand and decreased water availability. The Municipal Services Workgroup identified seven recommendations for promoting urban water use efficiency, including implementing DMMs and funding incentive programs for disadvantaged communities (DACs) and small districts (Table 6-1).

6.2.2 Improve Flood Management

Flood management comprises policies and practices related to educating the public, preparing for, mitigating damages related to, responding to, and recovering from flooding, as well as protecting the natural and beneficial functions of floodplains. The Flood Management RMS is divided into four approaches:

- *Nonstructural* – land use planning, floodplain mapping, risk assessment, land acquisitions and easements, building codes and flood proofing, permanent relocation, flood insurance, flood risk awareness;
- *Structural* – levees and flood walls, channels and bypasses, retention and detention basins, culverts and pipes, streambank stabilization, reservoir and floodplain storage, inspection and vegetation management, sediment removal, repair of structures;
- *Restoration of natural floodplain functions* – promoting natural hydrologic, geomorphic, and ecological processes, protecting and restoring floodplain habitats, invasive species reduction; and
- *Flood emergency management* – flood preparedness, emergency response, post-flood recovery.

These approaches all address the impacts of flooding, the risk of which may increase with future changes in the regional climate. Increasing temperatures, reduced snowfall, and earlier snowmelt may increase the risk of wildfire. Where severely burned acres drain to avalanche and debris chutes, and alluvial fans, excessive bedload and debris can worsen erosion for significant distances downstream in flood events after a wildfire. Increased probability of rain-on-snow events can create higher than anticipated runoff peaks. Protecting the floodplains through structural, nonstructural, and restorative approaches supports the watershed's ecological health and builds resiliency to flood events.

6.2.2.1 Flood Management

The non-structural and structural approaches to flood management have limited applicability to the region, given the rural setting, small population, expectation of limited growth, the large percentage of public land, and by the location of most communities in upper watershed areas away from active floodplains. The region does not face significant issues of new development in floodplains. Flood debris can block or cause floodwaters to overtop levees, channels, or culverts and bridges bypasses. Flood related sedimentation of streams, culverts, and reservoirs is a significant issue in the watershed, but is addressed in the Sediment Management RMS and through road and bridge and floodway improvement projects in the Plan.

A most significant flood management issue in the region is the loss of natural floodplain functions due to declining capacity of meadows, erosion and head cutting of streams, and reduced ability of the watershed to hold and release floodwaters. Rain-on-snow events, the severity and frequency of which may increase with climate change, can accelerate the loss of these functions. The Floodplains, Meadows, and Waterbodies Workgroup identified one recommendation: restoration of natural floodplain function to preserve and/or restore the natural ability of undeveloped floodplains to absorb, hold, and release floodwaters (Table 6-1).

6.2.3 Improve Operations Efficiency and Transfers

Improving operational efficiency of water management refers to exploring ways water infrastructure can be used to maximize regional and inter-regional beneficial uses of existing water supplies. Water infrastructure elements such as dams, canals, and pumping stations are often developed for single purposes by independent entities, but could be integrated into a more holistic water management network that uses all available water to maximize benefits. Improving operational efficiency may require changes to administration and facilities operations more so than new infrastructure, though minor modifications to facilities or construction of new conveyance interties may be necessary. Improving efficiency and connectivity of available water supplies also prepares the region to maintain water availability in anticipation of rising temperatures and decreased snowfall as a result of climate change.

6.2.3.1 Conveyance – Regional/Local

Regional conveyance is the conveyance or distribution of water from locally developed sources to end users located within the same watershed or river system. Conveyance systems are necessary to achieve benefits from virtually every other facet of local and regional water management such as recycling, water transfers, and both surface and groundwater storage. Improvements in system conveyance capacity can be achieved by locating and widening bottlenecks that constrict the movement of water. Conveyance capacity improvements can increase reliability without requiring increased supplies by increasing operational flexibility to move water between storage locations and points of use. Other potential benefits of improving regional conveyance capacity include improved water quality, reduced impacts to fisheries and streams, enhanced opportunities for conjunctive use, and increased surface and groundwater storage.

The most significant regional conveyance issues in the region are aging infrastructure and inadequate capacity. Continuing to study how anticipated climatic changes will place additional pressure on these systems can guide infrastructure and ecosystem upgrades that will respond to both current and future challenges. The Agricultural Lands Stewardship Workgroup identified six recommendations to improve regional conveyance, including repair and upgrade of aging infrastructure, replacement or improvement of canals, invasive weed control, and an improved description of the existing management system and capacity needs (Table 6-1).

6.2.3.2 System Reoperation

System reoperation describes the improvement of existing operations and management procedures of water facilities to meet needs more efficiently and reliably, rather than relying solely on infrastructure improvements. Minor physical changes to facilities may also be required. Examples of system reoperation include:

- Integration of flood protection and water supply systems to increase water supply reliability and flood protection, improve water quality, and provide for ecosystem protection and restoration;

- Reoperation of existing reservoirs, flood facilities, and other water facilities in conjunction with groundwater storage to improve water supply reliability, flood hazard reduction, and ecosystem protection and to reduce groundwater overdraft;
- Promotion of more effective groundwater management and protection and greater integration of groundwater and surface water resource uses, and;
- Improvement of existing water conveyance systems to increase water supply reliability, improve water quality, expand flood protection, and protect and restore ecosystems.

System reoperation focuses primarily on large-scale integration of State Water Project, Central Valley Project, and regional water project facilities. The Plan area includes several dams operated by the State Water Project, as well as hydroelectric facilities operated by Pacific Gas & Electric, and numerous facilities operated by the U.S. Forest Service and local water districts (see Table 3.11 for a list of dams in the Region). Opportunities for system reoperation in support of water management outside the watershed are necessarily mediated through management and operation of Oroville Dam; however, local benefits such as improved fisheries habitat, water quality, groundwater recharge, and flood management could accrue from reoperation of dams and other water facilities in the watershed. System reoperation in response to climate change impacts, such as decreased streamflow and precipitation, can help the region's hydropower resources along the Stairway of Power prepare for unavoidable impacts to hydropower production and may also enable communities dependent on that energy be better equipped for a diminished supply of power. The *Forest and Water Balance Study* (Appendix 3-2) considers the effects of forest densification on groundwater recharge and streamflows with implications for downstream dams and facilities.

The Municipal Services Workgroup identified three recommendations for promoting system reoperation: collaborating with federal, state, and local agencies on system reoperation studies, performing system audits, and conjunctive management (Table 6-1).

6.2.3.3 Water Transfers

Water transfers are sometimes seen as merely moving water from one beneficial use to another; however, in practice many water transfers become a form of flexible system reoperation linked to many other water management strategies. These strategies include surface water and groundwater storage, conjunctive management, conveyance efficiency, water use efficiency, water quality improvements, and planned crop shifting or crop idling for the specific purpose of transferring water. These linkages often result in increased beneficial use and reuse of water overall and are among the most valuable aspects of water transfers. Transfers also provide a flexible approach to distributing available supplies for environmental purposes. This ability to conserve, increase reliability, or build additional water supply through transfers helps the region adapt to climate change in the face of possible decreases in typical year flows.

A water transfer is a temporary or long-term change in the point of diversion, place of use, or purpose of use due to a transfer, sale, lease, or exchange of water or water rights. Transfers can be between water districts that are close by or across the state, provided there is a means to convey or store the water. A water transfer can be a temporary or permanent sale of water or a water right by the water right holder, a lease of the right to use water from the water right holder, or a sale or lease of a contractual right to water supply. Water transfers can also take the form of long-term contracts for the purpose of improving long-term supply reliability. Generally, water is made available for transfer by five major methods:

1. Transferring water from reservoir storage that would otherwise have been carried over to the following year. The expectation is that the reservoir will refill during subsequent wet seasons.
2. Pumping groundwater (groundwater substitution) instead of using delivered surface water.

3. Transferring previously banked groundwater either by directly pumping and transferring the banked groundwater or by pumping the banked groundwater for local use and transferring surface water that would have been used locally.[2]
4. Reducing the existing consumptive use of water through crop idling or crop shifting to make water available.
5. Water that seeps to saline or excessively polluted groundwater is irrecoverable without extensive treatment. Deep percolation, whether from canal seepage or from irrigated fields that would otherwise seep to unusable groundwater, can be captured and transferred if the seepage loss is prevented by applying water-use efficiency measures. Thus, unrecoverable seepage conserved from lining a canal or by switching from flood irrigation to drip can be transferred.

Opportunities for inter-regional water transfers in the region are limited and somewhat controversial at present; however, the large number of and diversity of water management entities within the watershed creates significant opportunities to increase regional efficiencies through water transfers within the region. The Municipal Services Workgroup identified three recommendations for increasing benefits from water transfers, including expanded groundwater management and monitoring programs, and exploring opportunities for intra-, inter-, and interstate- basin transfers (Table 6-1).

6.2.4 Increase Water Supply

Strategies to increase water supply include not only precipitation enhancement and conservation, but also conjunctive management of surface and groundwater as a single integrated source, enhanced surface storage, and recycling.

6.2.4.1 Conjunctive Management

Conjunctive management is the coordinated and planned use and management of both surface water and groundwater resources to maximize the availability and reliability of water supplies in a region to meet various management objectives. Surface water and groundwater resources typically differ significantly in their availability, quality, management needs, and development and use costs. Managing both resources together, rather than in isolation, allows water managers to use the advantages of both resources for maximum benefit. Conjunctive management thus involves the efficient use of both resources through the planned and managed operation of a groundwater basin and a surface water storage system combined through a coordinated conveyance infrastructure. Water is stored in the groundwater basin that is planned to be used later by intentionally recharging the basin when excess water supply is available, for example, during years of above-average surface water supply or through the use of recycled water.

A sustainable conjunctive water management program consists of several components that include investigating the groundwater aquifer characteristics, estimating surface water and groundwater responses, and appropriate monitoring of groundwater level and quality. In addition, reliable institutional systems for ensuring environmental compliance, providing long-term system maintenance, and managing contractual and legal features of the program are critical to sustainability. Conjunctive management may

[2] Groundwater banks consist of water that is "banked" during wet or above-average years. The water to be banked is provided by the entity that will receive the water in times of need. Although transfers or exchanges may be needed to get the water to the bank and from the bank to the water user, groundwater banks are not transfers in the typical sense. The water user stores water for future use; this is not a sale or lease of water rights. It is typical for fees to apply to the use of groundwater banks.

become more important as precipitation variability increases throughout the region as a result of climate change.

Conjunctive management would potentially benefit the region through better management of stormwater and groundwater. Because of the complex regional geology, there are 14 groundwater basins in the Plan area (Chapter 3 *Region Description* for a description of the groundwater basins in the Plan area), only one of which has a basin plan. The Agricultural Lands Stewardship Workgroup identified nine recommendations for promoting conjunctive management in the region, including public education, data gathering, monitoring, management plans for all groundwater basins, and increased groundwater recharge (Table 6-1). The Floodplains, Meadows, and Waterbodies Workgroup identified five recommendations to promote conjunctive management in the Plan area, including public education, increased monitoring, improved coordination with tribes and other local agencies, and restoration of wet meadows (Table 6-1).

6.2.4.2 Precipitation Enhancement

Also called cloud seeding, precipitation enhancement is a form of weather modification that artificially stimulates clouds to produce more rainfall or snowfall than they would produce naturally, by injecting substances into the clouds that enable snowflakes and raindrops to form more easily. Precipitation enhancement projects typically use silver iodide, supplemented with dry ice for aerial application. Occasionally, liquid propane or hygroscopic materials are used instead of silver iodide. In 2011, there were a total of 15 precipitation enhancement programs active in California, including one in the Lake Almanor area that is managed by Pacific Gas & Electric (PG&E). Most of the agencies or districts doing precipitation enhancement projects suspend operations during very wet years once enough snow has accumulated to meet their water needs. Additional precipitation generated by cloud seeding could offset demand on other water sources that may face diminished supplies as a result of climate change.

Precipitation enhancement could potentially benefit the region by increasing snow pack, but may have limited potential for further application beyond present levels, particularly in view of current climate trends. Natural precipitation decreases from west to east and from north to south in the Plan area, and the potential to artificially enhance precipitation from storms may be low in most of the upper watershed of the Middle Fork. Enhancing precipitation over the western slope of the Sierra Crest where natural precipitation is highest could result in more flow into Lake Oroville, but would not benefit most of the watershed, since most of the inhabited area and impoundment facilities lay east of the Sierra Crest. In addition, precipitation enhancement is often viewed with skepticism by local stakeholders because of concerns over its effects on environmental and human health.

The Floodplains, Meadows, and Waterbodies Workgroup identified two recommendations to increase knowledge regarding the effectiveness and health consequences of existing precipitation enhancement projects in the region, and to increase involvement of academics and local citizens in research related to the effects of cloud seeding on local communities (Table 6-1).

6.2.4.3 Municipal Recycled Water

The California Water Code (CWC) provides the following definition for recycled water: "water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource" (CWC Section 13050(n)) (CA Code 2016b). Recycled water can be divided into two categories: potable reuse and non-potable reuse. Potable reuse involves introducing recycled water directly into the domestic water supply or indirectly through a reservoir or groundwater basin. Non-potable reuse involves using recycled water for irrigation, agriculture, or industry. Typically, treated wastewater is discharged into rivers and streams as part of permitted disposal practices. Discharged water then comingles with the stream or river that may be a water source for downstream communities or agricultural users. Treated wastewater discharged into streams or shallow groundwater in the region become part of the streamflow. Or, as a consequence of increasing direct municipal recycled water use, the volume of treated water discharged into streams may be reduced, potentially reducing instream flows, including beneficial uses. Recognizing this, the CWC requires that prior to making any change in the point of discharge, place of use, or purpose of use of treated wastewater, the State Water Resources Control Board (SWRCB) reviews proposed changes to ensure potential impacts on beneficial uses are considered.

Making municipal recycled water available for irrigation and other agricultural uses would be a substantial benefit in the watershed. In the face of reduced snowpack and precipitation as a result of climate change, recycled water can reduce pressure on other surface and groundwater resources to meet demand. The Municipal Services Workgroup identified five recommendations to promote the use of municipal recycled water in the region, including funding, public outreach, and feasibility studies (Table 6-1).

6.2.4.4 Surface Storage – Local/Regional

Surface storage is the term for the use of human-made, aboveground reservoirs to collect water for later release when needed. Many California water agencies rely on surface storage as a part of their water distribution systems. Reservoirs also play an important role in flood control and hydroelectric power generation throughout California.

In addition, surface storage is often necessary to implement, or to maximize the benefits from, other water management strategies such as water transfers, conjunctive management of surface and groundwater, and conveyance improvements. There are two general categories of surface storage reservoirs: 1) those formed by damming an active, natural river; and 2) offstream reservoirs, which require a human-made diversion or pumping of water from a river into storage.

A significant amount of the larger local and regional surface storage in the region is by agencies managing water for uses downstream of Lake Oroville (Department of Water Resources/DWR) or for hydroelectric power generation (PG&E). Surface storage for local uses is generally in small impoundments (see Table 3-11 for a list of dams in the Region); exceptions are DWRs' Antelope Reservoir, which is managed for recreation, agricultural irrigation and instream flows, and Lake Davis, which contains Plumas County's State Water Project (Table A) water for domestic recreational and environmental uses. Increasing surface storage capacity in the region could benefit local users as well as increase flexibility to respond to climate-induced changes in timing of water availability and reduced watershed retention.

The Floodplains, Meadows, and Waterbodies Workgroup identified four recommendations to increase surface storage in the Plan area, including increasing capacity of existing facilities and timing water releases for agricultural and environmental uses, restoring meadows, wetlands, and riparian areas, and methods, studies, and tools for analyzing costs and benefits of future projects (Table 6-1).

6.2.5 Improve Water Quality

Protecting and improving water quality is a major priority of water management in California. Along with providing sufficient supply of water for all beneficial uses, water management agencies must ensure that the supplied water is of adequate quality to provide those beneficial uses. Drinking water and environmental uses require high-quality water, as do some industrial uses, while agriculture and other uses may be met by water that is not of sufficient quality for drinking. Preventing pollution and the accumulation of salts in the water supply, along with matching water quality to use are important tools for ensuring that the water supply meets the needs of all beneficial uses that rely on it. Addressing the following resource management strategies to improve water quality can help the Upper Feather River watershed adapt to anticipated impacts from climate change, including wildfires, increased temperatures, and changes in precipitation.

6.2.5.1 Drinking Water Treatment/Distribution


Water tanks (Source: Plumas-Eureka CSD)

Drinking water regulations mandated by the California Safe Drinking Water and Toxic Enforcement Act apply to all public water systems, regardless of ownership. The U.S. Environmental Protection Agency (EPA) is responsible for ensuring implementation of the federal Safe Drinking Water Act and related regulations. The state has primacy for the public water system regulatory program in California and works closely with the EPA to implement the program. In addition, local agencies such as county environmental health departments are responsible for regulating small public water systems (typically those serving fewer than 200 homes) in most counties. The EPA directly provides regulatory oversight for tribal water systems.

Common surface water treatment facilities include basic chlorine disinfection; sedimentation basins; filtration; and more recent technical advances, such as membrane filtration, ultraviolet light, and ozonation to meet pathogen removal and/or inactivation as well as disinfection requirements while reducing the formation of disinfection byproducts. Common facilities for groundwater sources that require treatment are chemical removal and/or blending facilities.

Issues of water quality in the watershed include aging and inadequate storage and distribution systems that are prone to leakage and backflow, outmoded treatment facilities, and high levels of arsenic in some water sources, which may be made worse as the frequency and severity of catastrophic wildfires increase in the region due to climate change. The Municipal Services Workgroup identified five recommendations for improving drinking water quality in the region, including funding to improve and repair aging infrastructure, upgrading and modernizing treatment facilities, and developing incentives to promote reduction of waste (Table 6-1).

6.2.5.2 Groundwater/Aquifer Remediation

Contaminants in groundwater can come from many sources, naturally occurring and anthropogenic. Examples of naturally occurring contaminants include heavy metals and radioactive constituents, as well as high concentrations of various salts from specific geologic formations or conditions. In addition, groundwater can be contaminated by anthropogenic sources with organic, inorganic, and radioactive constituents from point and nonpoint sources. These anthropogenic sources include industrial sites, mining operations, leaking fuel tanks and pipelines, landfills, impoundments, septic systems, and urban and agricultural activities. The contaminant having the most widespread and adverse impact on drinking water wells is arsenic, followed by nitrates, naturally occurring radioactivity, industrial and commercial solvents, and pesticides. Groundwater in some of the region is naturally high in arsenic.

Groundwater remediation removes contaminants that affect beneficial use of groundwater, by passive or active methods. Passive groundwater remediation allows contaminants to degrade biologically or chemically or disperse in the aquifer (in situ) over time. Active groundwater remediation involves either treating contaminated groundwater in situ or extracting contaminated groundwater from the aquifer and treating it outside of the aquifer (ex situ). Active in situ methods generally involve injecting chemicals into the contaminant plume. Ex situ methods for treating contaminated groundwater can involve physical, chemical, and/or biological processes. Remediating contaminated groundwater sources in the region may increase available water for human and environmental use, and create additional space for water transfers and storage. As climate change may reduce availability of existing water supply, additional supply from remediated groundwater could help buoy the water system to meet demand.

The Municipal Services Workgroup identified four recommendations to enhance groundwater remediation in the Plan area: protecting source waters, funding for monitoring and wellhead treatment, and in situ and ex situ treatment programs.

6.2.5.3 Matching Water Quality to Use

Matching water quality to use is a management strategy that recognizes that not all water uses require the same water quality. One common measure of water quality is its suitability for an intended use; a water quality constituent often is only considered a contaminant when that constituent adversely affects the intended use of the water. For example, high-quality water can be used for drinking and industrial purposes, and lower-quality water can be adequate for other uses. Some new water supplies, such as recycled water, can be treated for a wide range of purities that can be matched to different uses. The use of other water sources, such as recycled water, can serve as a new source of water that substitutes for uses not requiring potable water quality. Instream uses are directly influenced by discharge from wastewater treatment and stormwater flows; these source discharges can provide benefits and challenges to uses such as aquatic life and recreation and downstream users.

Human uses are categorized as consumptive (e.g., municipal, agricultural, and industrial supplies) and non-consumptive (e.g., navigation, hydropower generation, and recreation). Instream uses also include aquatic ecosystem uses, fish migration, spawning, and preservation of rare, threatened, and endangered species. Matching water quality to most of these uses is important because water is generally used as is (i.e., without treatment) with the exception of domestic and industrial uses.

Strategies for matching water quality to use include blending of water from different sources, water exchanges among entities that need water of different quality, and tailoring treatment of recycled water to the intended use. Most of these strategies are of limited applicability in the region, as there is little potential for water exchanges or blending among sources of different quality because most water in the Plan area originates in the Plan area. Recycling municipal water for irrigation use, and sustaining instream environmental and other surface water needs through groundwater recharge, are two areas of potential benefit for water management in the region.

6.2.5.4 Pollution Prevention

Pollution prevention is defined as reducing or eliminating waste at the source by modifying production processes, promoting the use of non-toxic or less toxic substances, implementation of practices or conservation techniques that reduce the generation and/or discharge of pollutants, and the application of innovative and alternative technologies which prevent pollutants from entering the environment prior to treatment. Sources of water pollution are categorized into two types: point source and nonpoint source (NPS). In California, point-source pollution prevention is addressed through Water Code Section 13263.3(d)(1), which authorizes the SWRCB, a Regional Water Quality Control Board (RWQCB), or a publicly owned treatment works to require a discharger to prepare and implement a pollution prevention plan. A point-source discharger is defined per Water Code Section 13263.3(c) as any entity required to obtain a National Pollutant Discharge Elimination System (NPDES) permit or any entity subject to the federal pretreatment program. A nonpoint discharger is any discharger not covered by a NPDES permit. Pollution prevention can contribute to the protection of water quality for beneficial uses by protecting water at its source and therefore reducing the need and cost for other water management and treatment options. By preventing pollution, water supplies can be used and reused by a greater number and variety of water users. Sources of pollution in the watershed include abandoned mine sites; agricultural runoff; livestock; watercraft; aging or inadequate septic fields; runoff from roads; and residential pollution such as pesticide and fertilizer use, and oils from vehicle.

The impacts of climate change identified in the vulnerability assessment include decreased precipitation and stream flows, increased temperatures, and increased risk of wildfire. All of these impacts can stress the watershed by increasing in-stream temperatures, decreasing summertime flows, and worsening sedimentation including losses of streamside and riparian vegetation as a result of increased wildfires. In the face of these additional challenges anticipated in future years, preventing pollution where possible is especially important. Doing so can reduce compounding stress on ecosystems and help build resilience across the watershed.

The Agricultural Lands Stewardship Workgroup identified eight recommendations to improve pollution prevention efforts in the region, including protection of source waters, livestock fencing of riparian areas, sealing of abandoned wells, sediment control, invasive species control, and management and monitoring of contaminants that lead to listing of streams as impaired under Section 303(d) of the Clean Water Act (Table 6-1). The Floodplains, Meadows, and Waterbodies Workgroup identified nine recommendations to improve pollution prevention in the Plan area, including reforming land and water management practices, restoring and protecting riparian areas, identifying and monitoring abandoned mines, controlling invasive aquatic species, and monitoring marinas and recreational facilities for impacts to water quality (Table 6-1).

6.2.5.5 Salt and Salinity Management

Salt and salinity management is the control of salts (including dissolved minerals such as lime, gypsum, and other slowly dissolved soil minerals) and salinity. Human causes of salinity include use of home water softeners, concentration of salts from treated water processes, and the use of fertilizers or soil amendments. The most common ions found in water are calcium, magnesium, sodium, potassium, bicarbonate, sulfate, chloride, and nitrate. Salt is present to some degree in all natural water supplies because soluble salts in rocks and soil begin to dissolve as soon as water reaches them.

Salinity management not only reduces salt loads that affect a region, it is also a key component of securing, maintaining, and recovering usable water supplies. Salt is ubiquitous throughout the environment and it is a conservative constituent – meaning it is never destroyed, only concentrated or diluted and transported. Since salts are ubiquitous, any water use and reuse increases salinity as each use subjects the water to evaporation. If reused water passes through soil, additional dissolved salts will be picked up. The continued concentration of salt is a major element of any recycled water project. Salts may accumulate in water conveyance and treatment facilities and must be removed at substantial cost to the operator.

Salt management involves source control, treatment, and dilution. Source control means limiting the initial concentration of salts through minimizing artificial inputs such as agricultural chemicals or using naturally less saline source water. Treatment refers to mechanical removal of salts with membrane filters or distillation, and is expensive, energy-intensive, and produces highly concentrated end products that must be stored or transported. Dilution is mixing low-salinity water with saline water to reduce the total concentration of salts. Real-time salinity management employs a form of dilution, timing the release of saline waters into a river with periods of high natural flow in order to keep salinity levels below thresholds for beneficial uses downstream. Salinity management issues are more prominent in coastal or arid regions, and in agricultural areas such as the Central Valley, than in upper watershed regions such as the Upper Feather River watershed; however, soils in Sierra Valley are considered highly saline due to high electrical conductivity (DWR 2013d).

The local benefits of sustainable salinity management include restoring and maintaining beneficial uses of water within the basin, securing and improving the reliability of the water supply, and enhancing local economic stability by providing reliable drinking water sources and water quality that supports local industries. The Municipal Services Workgroup identified two recommendations for salinity management in the region, including treatment and real-time salinity management (Table 6-1).

6.2.5.6 Urban Stormwater Runoff Management

Urban stormwater runoff management describes a broad range of activities to manage both stormwater and dry-weather runoff. Dry-weather runoff occurs when water flows to the storm drain because of activities such as excessive landscape irrigation, car washing, and other urban outdoor water uses. Urbanization alters flow pathways, water storage, pollutant levels, rates of evaporation, groundwater recharge, surface runoff, the timing and extent of flooding, the sediment yield of rivers, and the suitability and viability of aquatic habitats.

Urbanization creates impervious surfaces that collect pollutants that are washed off to surface waters during rain events. The impervious surfaces also increase runoff volumes and velocities, resulting in streambank erosion, and potential flooding downstream. Because of the emphasis on removing the water quickly, the opportunity to use storm-generated runoff for multiple benefits is reduced. Traditionally, urban stormwater runoff management was viewed as a response to flood control concerns resulting from the effects of urbanization; however, concerns about the water quality impacts of urban runoff have led water agencies to look at watershed approaches to control runoff and provide other benefits. As a result, urban stormwater runoff management is now linked to other resource management strategies.

A watershed approach for urban stormwater runoff management seeks to emulate and preserve the natural hydrologic cycle that is altered by urbanization. The watershed approach consists of best management practices (BMPs) designed to reduce the pollutant loading and reduce the volumes and velocities of urban runoff discharged to surface waters. Common BMPs include facilities to capture, treat, and recharge groundwater with urban runoff; public education campaigns to inform the public about stormwater pollution, including the proper use and disposal of household chemicals; and technical assistance and stormwater pollution prevention training. There are no stormwater management plans in the region.

The primary benefits of urban stormwater runoff management are to reduce surface water pollution and improve flood protection. Additional benefits include increasing water supply through groundwater recharge and reduced pollution. Groundwater recharge and stormwater retention sites can also be designed to provide additional benefits to wildlife habitat, parks, and open space. The general absence of urbanization in the Plan area reduces the potential for urban stormwater runoff issues; however, localized effects on water quality can still result from runoff. Although the scale of urban stormwater may be limited in the Plan area, low precipitation as a result of climate change may amplify pollutant buildup, creating an imperative to develop BMPs for pollutant load reduction.

The Municipal Services Workgroup identified five recommendations to improve urban stormwater runoff management in the region, including education and public outreach, coordination among stakeholders in stormwater management policies, and providing incentives for low-impact design features on new development and retrofitting of existing development (Table 6-1).

6.2.6 Practice Resource Stewardship

Integrated and sustainable water management must take into account the fact that water resources originate in upland areas. Uplands are the vast majority of the catchment area for precipitation, and nearly all surface water has passed over, under, or through upland soils before reaching a stream, wetland, or waterbody. The health of forested uplands, agricultural lands, meadows, floodplains, and groundwater recharge areas is essential to maintaining the quality and reliability of surface and groundwater supplies. In addition, all life depends on water, and a healthy natural environment contributes to human well-being through the providing of ecosystem services such as crop pollination, waste decomposition, carbon sequestration, air and water purification, and recreation. Appropriate stewardship of all the lands and resources in a watershed is integral to the management of water resources.

6.2.6.1 Agricultural Land Stewardship

Agricultural land stewardship refers to private farm and ranch landowners producing public environmental benefits (conservation of natural resources and protection of the environment) in conjunction with the food and fiber they have historically provided. Land managers practice agricultural land stewardship by conserving and improving land for food, fiber, biofuel production, watershed functions, and soil, air, energy, plants, animals, and other conservation purposes. Agricultural land stewardship also protects open space and the traditional characteristics of rural communities. Agricultural land stewardship practices can protect the health of environmentally sensitive land, recharge groundwater, improve water quality, provide water for wetland protection and restoration, reduce costs of flood management, and aid riparian restoration and management projects. Land can also be managed to improve water management, stormwater runoff control, water storage, conveyance, and groundwater recharge. Such stewardship practices are particularly advantageous as they do not rely on construction of major facilities and provide a range of environmental co-benefits.

Creek fencing and livestock crossing (Source: UFWG)

The Agricultural Lands Stewardship Workgroup identified 17 recommendations to promote agricultural land stewardship in the region, including improved funding, education, and outreach for promoting stewardship practices implementation, infrastructure development, program monitoring, information sharing, agency planning, conservation easements, stream restoration, water storage, vegetation management, carbon sequestration, and enhancing local appreciation for the importance of agricultural working landscapes (Table 6-1).

6.2.6.2 Ecosystem Restoration

Ecosystem restoration describes the improvement of modified natural landscapes and biological communities to provide for their sustainability and for their use and enjoyment by current and future generations. It is anticipated that increased temperatures and other climate change impacts will degrade ecosystem health. Restoration for past ailments and projected problems will strengthen the ecosystem and help species adapt to climate change impacts.

Few, if any, modified ecosystems can be fully restored to their pre-development condition. Instead, efforts focus on rehabilitation of important elements of ecosystem structure and function. Successful restoration increases the diversity of native species and biological communities and the abundance of habitats and connections between them. This can include reproducing natural flows in streams and rivers, curtailing the discharge of waste and toxic contaminants into water bodies, controlling non-native invasive plant and animal species, removing barriers to fish migration in rivers and streams, and recovering wetlands so that they can store floodwater, recharge aquifers, filter pollutants, and provide habitat.

Rivers and their associated floodplain ecosystems provide numerous benefits that can be thought of as goods and services. These include water purification, groundwater recharge, erosion control, storage of floodwaters, hydropower generation, soil-building, pollination, wood products, carbon sequestration, fisheries, wildlife, and recreation. The most significant ecosystem restoration issues in the region are restoration of healthy forest stands and degraded meadows. Other issues include sedimentation in streams, invasive species, and loss of fisheries habitat and fish populations. The modification of the region’s rivers by dams is a significant change to natural systems.

The Floodplains, Meadows, and Waterbodies Workgroup identified ten recommendations to promote ecosystem restoration in the watershed, including protecting streams and source waters from pollution; restoring natural stream flows and hydroperiods; restoring natural sediment transport regimes; removing barriers to the movement of fish and other aquatic organisms; establishing biological reserves and ensuring connectivity among habitat patches; and controlling invasive species (Table 6-1). The Uplands and Forests Workgroup identified 13 recommendations for promoting ecosystem restoration in the Plan area, including restoring and connecting habitats, protecting against catastrophic wildfire, restoring healthy forest stand densities, controlling invasive species, restoring and protecting source surface and groundwater (Table 6-1).

6.2.6.3 Forest Management

Forest management is the application of forestry principles, practices, and business techniques to the management of forested lands to achieve the owner's objectives. Different forest landowners have different goals and objectives and different strategies to accomplish them; however, the water produced by these forests has economic value that equals or exceeds that of any other forest resource. Forest management activities can affect water quantity and quality. For purposes of water management, this strategy focuses on forest management activities on both public- and privately-owned forest lands for the conservation of forest ecology and productivity, including favorable flows of water that originate from forestlands.

The vast majority of forested lands in the region are managed by the U.S. Forest Service, mostly in Plumas National Forest, but also including parts of Tahoe and Lassen National Forests. National Forests were established under the Organic Act of 1897, which specifically states that a primary purpose of these lands is to “secure favorable conditions of water flow.” Direct management of these forested lands is the responsibility of the USFS, and implementation of resource management strategies under this Plan will depend on the management plans of that agency. Forest management issues in the watershed that affect water supply and quality include increased sedimentation caused by erosion from poorly maintained roads and areas burned by fires; reduced water retention caused by either loss of canopy from catastrophic fire or from unnaturally high stand densities due to fire suppression and lack of biomass utilization facilities ; conversion of forest to brush following fires; and pollution from abandoned mine sites and other past land uses on public lands now managed by the USFS. Private forest owners include W. M. Beaty and Associates, Soper-Wheeler Company, Collins Pine Company, and Sierra Pacific Industries.

Rising temperatures and longer dry seasons, both of which are expected in the Upper Feather River (UFR) watershed because of climate change, increase the risk of wildfire. Rising temperatures and earlier snowmelt are shown to increase the frequency, size, and severity of wildfires, trends that align with wildfire activity in the Sierra Nevada since the early 1980s. In addition to the increased risk of wildfires from higher temperatures and ongoing drought, increasing fuel supply exacerbates the risk. As rains replace winter snows due to rising temperatures, plant growth is expected to accelerate, increasing moisture competition and stress in living trees and increasing dead and ladder fuel flammability for wildfires. Catastrophic wildfire removes vegetative cover and reduces the stability of soils, increasing erosion rates and runoff for months to decades. If a heavy rain event occurs after a fire, soil, ash, and sediment can flow into surface waters in the UFR watershed, degrading water quality. Climate projections estimate that when precipitation does occur, it will be in the form of heavy rains, increasing the volume of water to carry sediment over burned areas into streams and waterbodies. Managing forests through strategic fuel reduction and forest management can help protect the watershed's ecosystem and promote high water quality.

The Uplands and Forests Workgroup identified three recommendations for forest management in the Plan area: 1) integrated research and implementation projects to assess the effects of a wide range of forest management practices and watershed trends in the region, 2) monitoring, modeling, and studies to assess the effects of climate change, and 3) study the effect of increasing forest densification for forest health and surface water and groundwater conditions (Table 6-1). The Tribal Advisory Committee (TAC) identified four recommendations for forest management in the region, including restoring natural fire regimes, and employing traditional ecological knowledge (TEK) in collaborative studies and projects to restore water quality and control the spread of invasive species (Table 6-1).

6.2.6.4 Land Use Planning Management

Land use planning is the orderly and planned use of land, resources, facilities and services with a view to securing the physical, economic and social sustainability, health, and well-being of urban and rural communities. Stronger collaboration between land use planners and water managers can promote more sustainable and efficient land-use patterns and integrated regional water management practices, which can produce safer and more resilient communities. Integrating land use and water management consists of planning for the housing and economic development needs of a growing population, while providing for the efficient use of water, water quality, energy, and other resources. Land use decisions can also help reduce greenhouse gas (GHG) emissions, which contribute to climate change, by encouraging alternative modes of transportation (such as walking and biking) and green building (which reduces a home or building's energy use). Land Use Planning and Management RMS emphasize strategies to promote compact and sustainable urban and rural development.

While the region is projected to experience a slight decline in population through 2030, the on-going shift in the regional economic base toward tourism, seasonal residents, services, and health care will still drive new development (see Section 3.3 for a discussion of demographic and economic trends in the Plan area). All four workgroups identified recommendations for land use planning, including planning for compact and sustainable development; directing development away from wetlands, meadows, and recharge areas; improved communication among land use planners, water managers, and agencies; and agriculture-supportive goals and strategies in county land use plans (Table 6-1).

6.2.6.5 Recharge Area Protection

Recharge areas are those areas that provide the primary means of replenishing groundwater. Good natural recharge areas are those where high-quality surface water is able to percolate through the sediments and rocks to the saturated zone that contains groundwater. If recharge areas cease to function properly, there may not be sufficient groundwater for storage or use. Protection of recharge areas is necessary to maintain the quantity and quality of groundwater in the aquifer; however, protecting recharge areas by itself does not provide a supply of water. Recharge areas are functioning properly when aquifer storage capacity is available, sufficient permeable surface is present, and an adequate supply of high-quality water to recharge the aquifer is available.

Because of its location in the upper watershed, adequate supply of high-quality surface water is generally not an issue in most of the region. Rather, the principal issues of groundwater recharge in the watershed are reduced infiltration and retention of surface water in forested uplands, loss of wetland functions in meadows, and the shift in precipitation from snow to rain. The Floodplains, Meadows, and Waterbodies Workgroup identified several recommendations for recharge area protection in the region, including identifying actual and potential recharge areas, protecting and restoring meadows (Table 6-1).

6.2.6.6 Sediment Management

Sediment management refers to the management of fine solid fragmented material such as silt, sand, and clay, which is suspended in or settled on the bottom of a water body. Like water, sediment is a valuable resource and is vital to the functioning of beaches, wetlands, spawning beds, and riparian habitat. Sediment deposited by floodwaters is also a source of fertile agricultural soils. However, excessive sediment can lead to clouded water, degraded wildlife habitat, barriers to navigation, and decreased storage capacity in reservoirs, among other things.

Source management is preventing soil loss and adverse sediment flows from land use activities that may, without proper management, cause erosion and excessive sediment movement. Routine source management activities prevent or mitigate excessive sediment introduced into waterways due to recreational use, roads and trails, grazing, farming, forestry, and construction. Erosion of uplands caused by roads and fires, along with erosion and incision of stream channels in meadows, causes excess sedimentation in streams and reservoirs in the watershed. The impacts of climate change may also create need for increased sediment management, as more intense, severe storms may lead to increased erosion and turbidity in surface waters.

The Agricultural Lands Stewardship Workgroup identified six recommendations to improve sediment management in the region, including education and outreach, evaluation and management of sediment sources such as roads and burned areas, evaluation of agricultural water delivery infrastructure for sediment management needs, and re-use of sediment removed during mitigation for beneficial uses such as wetland restoration and agriculture (Table 6-1). The Uplands and Forests Workgroup identified four recommendations to improve sediment management in the region, focused on coordination of state and federal agency regulations and practices and on post fire recovery (Table 6-1).

6.2.6.7 Watershed Management

Watershed management is the process of creating and implementing plans, programs, projects, and activities to restore, sustain, and enhance watershed functions. These functions provide the goods, services, and values desired by the human community that are affected by conditions within a watershed. A primary objective of watershed management is to increase and sustain a watershed’s ability to provide for the diverse needs of the communities that depend on it including local, regional, state, federal, and tribal stakeholders. Watershed management initiatives should work to blend community goals and interests with the broader goals of the state as a whole in a manner consistent with improving environmental, social, institutional, and economic conditions within the watershed. The need to incorporate environmental justice and social equity should also be recognized and addressed, along with more traditional project management approaches.

The Floodplains, Meadows, and Waterbodies Workgroup identified 16 recommendations to promote watershed management in the region, including improving the scientific basis of projects and of monitoring programs that track changes and disseminate information to stakeholders, preserving and restoring habitats, species, and soils, and improving coordination and information sharing among stakeholders (Table 6-1). The Uplands and Forests Workgroup identified ten recommendations to promote watershed management in the region including integrating traditional ecological knowledge into monitoring and project assessment, improving interagency cooperation, involving federal agencies as partners in grant programs, allowing federal funds and in-kind services to be used as matching funds, and developing science-based projects to accomplish landscape-scale ecosystem restoration (Table 6-1).

6.2.7 People and Water

Water management is a human activity, undertaken because people have an unbreakable relationship to, and dependence on, water. Essentially all water management infrastructure exists to provide water to people for out of stream uses. In-stream environmental water uses affect people through human cultural, spiritual, economic, and aesthetic relationships to water and the natural systems it supports. Encouraging conservation, efficient use, and protection of water resources among the public can have positive effects on all other aspects of water management. Recognizing the need to incorporate the relationships between people and water is important to effective and sustainable water management.

Kayaker on Frenchman Lake (Courtesy of Kristi Jamason)

6.2.7.1 Economic Incentives

Economic incentives include financial assistance, water pricing, and water market policies intended to influence water management. Economic incentives can influence the amount and timing of water use, the source of supply, and the volume of wastewater produced. State grant programs help fund planning and infrastructure projects designed to enhance water use efficiency, as well as subsidies for services to disadvantaged communities. Most urban water suppliers in California are moving toward tiered rate structures in which the unit water charge increases as water use increases. Policies that facilitate water transfers and water banking among agencies increase resiliency to drought and improve efficiency. Economic incentives to support sustainable water management can help protect water supplies that will become increasingly vulnerable because of climate change impacts. Additionally, reductions in water lead to reductions in energy use that would have previously been needed to process the water, thereby reducing greenhouse gas emissions.

The Municipal Services Workgroup identified three recommendations for utilizing economic incentives in the region: regular review and adjustment of water rates and using tiered rate structures, and adopting policies that promote long-term water use efficiency (Table 6-1). The Uplands and Forests Workgroup identified four recommendations for utilizing economic incentives in the region: reducing barriers and liabilities to managed burning, developing programs that support biomass utilization, groundwater recharge, and catastrophic fire reduction, managed fire reintroduction, integrating traditional ecological knowledge into program implementation and evaluation, and improving capacity of local stakeholders to carry out RMS implementation (Table 6-1).

6.2.7.2 Outreach and Engagement

Outreach and engagement describe the use of public communication tools and practices by water agencies to encourage public groups and individuals to contribute to positive water management outcomes. Public outreach and engagement produce two broad types of benefits: instrumental, outcome-oriented benefits (such as designing a program that satisfies multiple criteria) and intrinsic, process-oriented benefits (such as building trust between participants). Public involvement leads to instrumental outcomes in two ways. First, public involvement results in a citizenry that is more understanding and appreciative of the issue, and thus one that makes informed decisions. Second, public involvement assists agencies in making better decisions as a direct result of including public knowledge. In addition to instrumental outcomes, public involvement provides many intrinsic benefits, such as enhanced community capital. Outreach and engagement that incorporates lessons about the impacts of climate change can help create a more prepared community and encourage residents to engage and support activities that reduce GHG. Outreach and engagement efforts range from informing and educating to empowering, and the tools used mirror the goals of engagement.

The Agricultural Lands Stewardship Workgroup identified eight recommendations to improve public outreach and engagement for water management in the region that include using varied media for outreach and engagement; making data and agency contact information available to the public; using project-specific education and outreach as well as established programs; and training managers and board members of local agencies and organizations how to engage the public (Table 6-1). The Uplands and Forests Workgroup identified three recommendations to improve public outreach and engagement for water management in the region: incorporating outreach and education into project implementation, expanding existing education programs, and working with adjacent and downstream landowners to improve understanding of benefits that result from large scale and coordinated watershed projects (Table 6-1).

6.2.7.3 Water and Culture

Incorporating culture into water management increases awareness of how cultural values, uses, and practices are affected by water management, and how they affect water management. Water and water-dependent resources shape individual and collective experiences that contribute to individual and community well-being, sense of identity, and connection with the natural world. These experiences are inextricably linked to values, traditions, and lifestyles, which in turn inform perspectives and expectations regarding water resources and conditions. Understanding these connections, and how these relationships may change because of climate change, can help communities prepare for impacts and protect or adapt cultural values. Cultural considerations by their nature are inherently linked to every resource management strategy. Expression of cultural connections to water and water-dependent resources can involve a wide range of activities and material objects.

The Tribal Advisory Committee identified two recommendations for incorporating cultural considerations into water management in the region: recognizing as beneficial uses those that support the cultural, spiritual and traditional lifeways of California Indian Tribes, Tribal communities and families, and integrating and applying TEK in collaboration with Tribes, Tribal organizations, and cultural traditional ecological practitioners (Table 6-1).

6.2.7.4 Water-dependent Recreation

Water-dependent recreation describes recreation activities in or on water, including fishing, swimming, skiing and snowboarding, waterfowl hunting, motor boating, wind surfing, kayaking, and passive recreation activities that can be enhanced by water, such as wildlife viewing (including birding), picnicking, biking, relaxing on the beach, camping, and hiking. The right of public access to navigable waterways, lakes, and beaches is protected by a variety of federal, state, and regional laws. Agencies such as the Federal Energy Regulatory Commission and the State Water Project are required by law to consider recreation in their decisions and projects. As resource extraction industries decline, the economy of the region is trending more heavily toward tourism and recreation, most of which is water-oriented. As winter snows and summer runoff are expected to diminish as climate change worsens, recreation that depends on healthy streams (such as birding and fishing) or high water levels (such as boating and swimming) is increasingly at risk. This has potential for impacts in the tourism and recreation sectors of the regional economy.

The Floodplains, Meadows and Waterbodies Workgroup identified 11 recommendations for water-based recreation in the watershed, including identifying recreational and educational opportunities in the region; reducing impacts from water recreation; restoring water quality, fish populations, and riparian systems in the region; and educating residents and businesses in the watershed about their role in protecting water quality and recreational opportunities (Table 6-1).

6.2.8 Other Strategies

Other strategies are management strategies that can potentially generate benefits that meet one or more water management objective(s), but have limited capacity to strategically address long-term regional water planning needs. These are unique or uncertain strategies that do not fit into the framework of the RMSs discussed previously. Some have only local or specific application, and others rely on unpredictable conditions.

6.2.8.1 Miscellaneous

The Agricultural Lands Stewardship Workgroup identified three strategies not included in other RMSs that would further the goals and objectives of the IRWM Plan:

1. Windbreaks and snow fences: Snow fences slow the velocity of wind, which cause the deposition of snow downwind of the fence. Snow fences do not increase the total amount of snow that falls, but they concentrate snowfall in small local areas (1.25 acres or less), creating deeper snow pack in some places and shallower or no snow pack in others. Deeper snow pack melts more slowly, which extends the release of winter precipitation farther into the summer dry season.

2. Reestablish historic wetlands: Where possible, wetlands that have been converted to other uses or lost to stream erosion could be restored to increase water retention, improve water quality, and enhance wildlife habitat.

3. Rain fed agriculture: Rainfall in real time provides all crop consumptive water use directly. Owing to the unpredictability of rainfall frequency, duration, and amount, there is significant uncertainty and risk in relying solely on rained agriculture. This is especially true in California, where there is little or no precipitation during most of the spring and summer growing season. Rain fed agriculture is successful in parts of California where winter wheat is cultivated without irrigation, producing extra crop yield that can replace a portion of summer yield lost to reduced irrigation. The cold winters and low

precipitation of agricultural areas in the region make rained agriculture an uncertain strategy, but one that still merits study.

The Uplands and Forests Workgroup identified nine strategies for forest and fuels management not included in other RMSs:

1. Reduce risk of wildfire through strategically located fire breaks for ridgeline lightning, roadway, and railroad ignitions,

2. Forest and fuels management for protection of critical habitats.

3. Snow zone fuels and fire management.

4. Wildfire liability reduction.

5. Wildland-Urban Interface (WUI) fuels management.

6. Traditional Ecological Knowledge (TEK) to reintroduce historic fire regimes.

7. Community recharge area management to protect domestic and agricultural wells from catastrophic wildfire and from reduced groundwater infiltration or excessive siltation.

8. All-scale biomass utilization including community and tribal biomass projects.

9. Landscape-scale forest and fuels management that includes multiple (#1-#8) fire and fuels management strategies.

6.2.8.2 Wastewater/NPDES

The Municipal Services Workgroup added the wastewater and NPDES permitting management strategy and identified five recommendations to improve wastewater management facilities and administrative/operator capacity in the region:

1. Water and wastewater treatment as a resource management strategy potentially includes integration of agricultural and domestic wastewater into the water supply equation. Water/wastewater treatment has been a significant issue for several decades.

    - Regional facilities to treat wastewater to a level necessary for recycled or potable use.
    - Water/wastewater treatment as a supply option through groundwater recharge and/or other means.

2. Aging wastewater infrastructure and the need for upgrades to meet new and revised state standards. This strategy will also be important when considering water-recycling opportunities. Actions might include:

    - Facility upgrades.
    - Assessment of private sewage treatment for safety next to wells in areas of semi-dense development (one-acre plots).
    - Development of strategies for wastewater treatment to ensure the maintenance of receiving water quality.

3. Infrastructure reliability: recognizes the importance of maintaining and upgrading infrastructure for water supply, treatment, and distribution; wastewater collection, treatment, and disposal; and recycled water treatment and distribution. Infrastructure improvements are continually needed as facilities age, demands on their use increase (due to population growth, degraded water quality, or increased water quality standards), and new technologies are introduced.

4. Provide training in wastewater collection, treatment, and disposal that will increase the certified operational pool in the region (succession planning).

5. Increase public outreach activities to promote the water and wastewater fields as career paths.

6.3 Strategies not Applicable to the Upper Feather River Region

The following RMSs from the *California Water Plan Update 2013* were considered but not included in the UFR IRWM Plan because they are not applicable to the Upper Feather River region.

6.3.1.1 Conveyance – Delta

The State of California is developing a large-scale plan for conveyance of water through the Sacramento-San Joaquin Delta, which is the confluence point of the Sacramento and San Joaquin Rivers that drains to the Pacific Ocean. The purpose of the state plan is to promote coequal goals of protecting the Delta ecosystem and maintaining a stable supply of water for California. While the Upper Feather River region is a major contributor of water to the State Water Project, water from the Plan area reaches the Delta through the Lower Feather River and Sacramento River, which are outside the IRWM region.

6.3.1.2 Desalination

Desalination involves removal of salts from brackish and saline water through various technologies. The UFR Region does not include any coastal or other saline waters.

6.3.1.3 Surface Storage – CALFED/State

CALFED is a joint federal-state effort created to coordinate activities in the Sacramento-San Joaquin Delta. The state and federal governments have funded investigations into five sites for surface storage that would meet the goals of water supply reliability, water quality, and ecosystem restoration. None of these five sites is in the UFR Region.

6.4 Strategy Recommendations

6.4.1 Process

In April 2015, the RWMG reviewed and discussed the RMS, removing those not relevant to the region and requesting that workgroups select RMSs for which they would be responsible. In May, the RWMG assigned the remaining applicable RMSs to workgroups to ensure each applicable RMS was addressed. Additionally, in May 2015, Tribal representatives volunteered to develop recommendations for several of the RMSs, primarily those related to water and culture.

Each of the workgroups used a collaborative process to develop recommendations for their assigned RMS, considering the strategy recommendations identified in the *California Water Plan 2013 Update* and those identified by other IRWM regions. The RMS recommendations were thoroughly reviewed and vetted by workgroup participants and presented to the RWMG at public meetings in November 2015 and January 2016.

6.4.2 Matrix of Recommendations

Table 6-1 provides a matrix of the recommendations each Workgroup identified for the 27 Standard RMSs applicable to the UFR Region. These strategy recommendations are tailored to the specific goals and objectives of the IRWM Plan (see Appendix 6-1 for identified linkages between RMS recommendations and Plan objectives). A blue dot ● indicates that the Workgroup strategy recommendation is supportive of climate change adaptation or GHG efforts.

Table 6-1. Summary of Workgroup Recommendations for Resource Management Strategies

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
Objective: Reduce Water Demand			
1	Agricultural Water Use Efficiency	Agricultural Land Stewardship	Education, Data and other Technical Assistance: 1. Explore and identify techniques to improve overall agricultural water use efficiency. 2. Expand water efficiency information, evaluation programs and on-site technical assistance reaching water suppliers, farmers and ranchers, through academic institutions, including agricultural extension services, Resource Conservation Districts (RCD), independent crop advisors, and other agricultural outreach efforts. 3. Agricultural, water and environmental stakeholders develop community educational and motivational strategies for conservation activities to foster water use efficiency. 4. RCDs and groundwater districts in agricultural areas collect--and UC Cooperative Extension and Plumas-Sierra Agriculture Departments document--promising practices and plans for droughts and other water shortages. 5. Develop sources of real-time data to provide irrigators and water managers with better information with which to make water management/irrigation decisions, such as: a. Local meteorological/weather data b. Soil moisture data (meters) c. Water application/use monitoring d. Surface water depth and flow data e. Surface to groundwater depth f. Groundwater modeling 6. Develop methods to quantify and communicate water savings and costs associated with hardware upgrades, water management, and evapotranspiration reduction projects. 7. Develop consistent, watershed-wide methodology for collecting and reporting water use information by users and suppliers (groundwater and surface) that is consistent with state requirements. 8. Develop comprehensive educational, informational, and awareness efforts regarding sustainability of consumption of local products in the water-use efficiency programs for growers, water suppliers, post-harvesting processors, consumers, and others. Encourage reducing long-distance commodities transporting and importing commodities and thus, reduce energy use and greenhouse gas emissions. Use of Promising Practices: 9. Steward soil and wetland areas for increased groundwater holding and recharge, as well as sediment management.

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
			10. Employ flood management capacities of agricultural land to support groundwater recharge, reduce infrastructure damage, control erosion and sedimentation of waterways and improve downstream water quality: a. Explore diversion of flood/high season water to aboveground storage areas b. Employ flood easements to compensate farmers/ranchers who allow fields to be flooded during extreme events 11. Utilize conservation easements and proven (or promising) practices to protect water supplies and water quality. 12. Adjust irrigation schedules and methods to decrease the amount of water used or applied, including possible use of low energy precision application (LEPA) for center pivots. 13. Provide help to convert to more drought-resistant or less-water-consumptive cropping. 14. Identify appropriate water efficiency methods, encourage pilot/demonstration projects, track water efficiency measures and resulting savings–publicly available, consolidated at regional level, e.g., by Valley (Indian Valley, American Valley, Sierra Valley, Mountain Meadows)–to preserve privacy. 15. Facilitate use of available recycled water that otherwise would not be used beneficially, e.g., use of treated wastewater from mills, treatment plants, etc. for irrigated pasture; widespread use of graywater. 16. Implement source water protection measures.
2	Urban Water Use Efficiency	Municipal Services	1. Implement programs such as best management practices. 2. Provide information to homeowners regarding water efficient landscapes. 3. Increase public outreach and encourage community involvement. 4. Fund incentive programs for small districts and disadvantaged communities (DAC). 5. Conduct large landscape surveys and develop water efficient landscape guidelines. 6. Conduct audits of internal water distribution systems. 7. Identify excessive water users and offer water audits.
Objective: Improve Flood Management			
3	Flood Management	Floodplains, Meadows, Waterbodies	1. Restore floodplain function to preserve and/or restore the natural ability of undeveloped floodplains to absorb, hold, and release floodwaters.
Objective: Improve Operational Efficiency and Transfers			
5	Conveyance - Regional/Local	Agricultural Land Stewardship	1. Improve aging infrastructure, increase existing capacities, and/or add new conveyance facilities. 2. Add fish ladders and state-of-the-art fish screens to conveyance structures. 3. Establish a baseline hydrology and enhanced description of present water management system components.

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
			4. Replace or improve canal structures to improve the ability of irrigation districts, water companies and other entities to manage and control water in the region and reduce spillage. 5. Control invasive weeds to improve flow, reduce spread of weeds, and reduce sedimentation and bank erosion/degradation. 6. Evaluate conveyance infrastructure for risk from earthquake and flood, and the role it could play in flood control. Plan for needed improvements.
6	System Reoperation	Municipal Services	1. Collaborate with federal, state, and local agencies on system reoperation studies. 2. Perform system audits to identify operational improvements that can be made. 3. Encourage conjunctive management.
7	Water Transfers	Municipal Services	1. Develop and implement groundwater management plans, monitoring programs. 2. Assemble data from existing monitoring programs and analyze them in an effort to identify additional areas to monitor. 3. Consider inter-, intra-, and interstate basin transfers to maximize water use.
Objective: Increase Water Supply			
8	Conjunctive Management	Agricultural Land Stewardship	1. Assess the connection between groundwater, spring and surface water sources and recharge areas to better understand their interactions. 2. Identify tools and data sharing needed to improve surface, groundwater and conjunctive water management: a. Develop and make available to the public a consolidated map of groundwater basins, recharge areas, California Statewide Groundwater Elevation Monitoring (CASGEM) wells, state websites (e.g., Groundwater Ambient Monitoring and Assessment Program [GAMA]) and data for all groundwater basins in the UFR watershed b. Regular monitoring of surface and groundwater levels and quality throughout watershed with publicly accessible data: o Hydrogeologic characterization of the aquifers o Changes in groundwater levels o Groundwater flow (inter-basin + to/from streams) o Groundwater quality o Land subsidence, if any o Surface water flow o Surface water quality o Interaction of surface and groundwater

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
			3. Implement a program to promote public education about groundwater and its relation to surface water, including: a. Interconnection of surface water and groundwater b. Benefits of recharging groundwater with surface water and recycled water c. Importance of protecting groundwater quality and recharge areas d. Seasonal versus long-term changes in groundwater levels e. Potential impacts of climate change on groundwater resources f. Organizations with management responsibility: obtain contact info, responsibilities, etc. g. Data sources 4. Coordinate surface and groundwater management where local agencies overlap geography. 5. Preparation and execution of sustainable groundwater management plans for all groundwater basins (not just Sierra Valley), that protect groundwater elevation and quality, surface water-groundwater interaction and groundwater ecosystem services. 6. Increase local and regional groundwater recharge and storage to reduce groundwater depletion. 7. Monitor and possibly execute on developments if/when SWRCB creates "measures whereby agencies proposing to use peak surface water flow for groundwater recharge are not subject to potential protest of their existing water right, in order to stipulate groundwater recharge as a reasonable beneficial use of their surface water right." 8. Improve and repair infrastructure that supports the conjunctive use of surface and groundwater. 9. Explore, map, and conduct overall evaluation of potential for groundwater banking.
		Floodplains, Meadows, Waterbodies	1. Implement monitoring, assessment, and maintenance of baseline groundwater levels. 2. Encourage local water management agencies to coordinate with tribes and other agencies involved in activities that might affect long term sustainability of water supply and water quality. 3. Local groundwater monitoring and management activities and feasibility studies to increase the coordinated use of groundwater and surface water. 4. Restore wet meadows to full biological function to enhance storage and more continuous release of shallow groundwater. 5. Implement a program to promote public education about groundwater and surface water connectivity.
10	Precipitation Enhancement	Floodplains, Meadows, Waterbodies	1. Collect data and evaluate existing California precipitation enhancement projects within the UFR Region on their effectiveness and impact on water quality and human health.

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
			2. Collaborate with academic institutions, agencies, and local citizen groups on research.
11	Municipal Recycled Water	Municipal Services	● 1. Increase funding availability for water reuse/recycling facilities and infrastructure. ● 2. Create education curriculum for public schools and institutions of higher learning to educate the public about recycled water. 3. Engage the public in an active dialogue and encourage participation in the planning process of water recycling projects including non-potable and potable applications. 4. Provide resources (i.e. funding) to agencies that will perform comprehensive analyses of existing water recycling projects to estimate costs, benefits, and water deliveries. 5. Assess water recycling technology to determine least costly and environmentally appropriate technology based on location and need.
13	Surface Storage - Regional/Local	Floodplains, Meadows, Waterbodies	● 1. Increase surface storage and timed releases for agricultural and natural resource purposes. ● 2. Increase water-holding capacity of riparian vegetation and wetlands. 3. Develop a comprehensive methodology for analyzing project benefits and costs by local agencies. ● 4. Continue studies, research, and dialogue to identify a common set of tools for determining costs and benefits of local surface storage projects, and assess need for determining need for future projects.
Objective: Improve Water Quality			
14	Drinking Water Treatment and Distribution	Municipal Services	● 1. Develop incentives to allow water systems to reduce waste of limited water resources. 2. Provide additional funding for water supply, water treatment, and infrastructure projects to ensure safe and reliable supply of drinking water for individuals and communities. 3. Improve treatment facilities to include more sophisticated methods of treatment such as membrane filtration, ultraviolet light, and ozonation. 4. Upgrade aging water storage and distribution systems, which may have an impact on water quality that pose public health risks. 5. Improve water system to prevent cross connections and backflow in distribution systems.
15	Groundwater Remediation/ Aquifer Remediation	Municipal Services	● 1. Implement source water protection measures. ● 2. Establish and supporting funding for detecting emerging contaminants by commercial laboratories and installation of wellhead treatment systems. 3. Treat contaminated groundwater while it is still in the aquifer (in situ). 4. Extract contaminated groundwater from the aquifer and treating it outside of the aquifer (ex situ).
16	Matching Water Quality to Use		1. It may be possible in the region to allocate effluent for in-stream use.

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
			2. It may be appropriate that water used in industrial processes, such as in timber mills, could be of non-potable quality in order to preserve potable water for human consumption. 3. Manage water supplies to optimize and match water quality to the highest possible use and to the appropriate technology. 4. Encourage upstream users to minimize the impacts of nonpoint urban and agricultural runoff and treated wastewater discharges. 5. Review projects to determine the potential impacts from wastewater elimination into local streams. 6. Support research into solutions to the potential conflicts between ecosystem restoration projects and the quality of water for drinking water purposes.
17	Pollution Prevention	Agricultural Land Stewardship	1. Regional, tribal, and local governments and agencies should establish drinking water source and wellhead protection programs to shield drinking water sources and groundwater recharge areas from contamination. 2. Encourage the use of riparian-area livestock fencing to reduce or prevent water-borne pathogens. 3. Control sediment from dirt roads, fires/burned areas and agricultural operations. 4. Encourage community composting; make available to increase carbon sequestration in soil. 5. Reduce invasive species. 6. Resource Conservation Districts provide technical support for agricultural practices and crop systems that result in lower greenhouse gas (GHG) emissions. 7. Address improperly destroyed, sealed, and abandoned wells that can serve as potential pathways for groundwater contamination. 8. Manage/monitor and control Clean Water Act Section 303(d) listing constituents (sediment, temperature, DO, pH, nutrients) through: a. Improve systems for irrigation return water b. Irrigated Lands Regulatory Program (ILRP) implementation of cattle exclusion c. Point source exclusions d. Best management practices for timber harvest and catastrophic wildland fire rehabilitation e. Restore wet meadows f. Roads decommissioning and restoration g. Reduce sedimentation into watersheds h. Control pesticide and herbicide contamination

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
		Floodplains, Meadows, Waterbodies	1. Develop proper land management practices that prevent sediment and pollutants from entering source waters and waterbodies. 2. Restore degraded riparian habitats where elevated sediment or turbidity cause nuisance or adversely affect beneficial uses per the Basin Plan. 3. Assess the costs and impacts of current water quality management activities, and use this assessment to guide future implementation programs. 4. Identify abandoned mines throughout the region and assess the level to which these sites contaminate regional waters. 5. Construct and maintain livestock exclusions around sensitive meadow and riparian habitats, particularly in areas that are important for groundwater recharge or source water protection. 6. Assess and Identify source(s) of pollutants to waterbodies. 7. Establish monitoring protocol for marinas and recreational boating facilities. 8. Establish criteria for preventing/monitoring invasive aquatic species introduction to waterbodies 9. Identify where recreational development has harmed water quality in the region and take action to remediate it
18	Salt & Salinity Management	Municipal Services	1. Utilize treatment options such as membrane or distillation technologies 2. Real-time salinity management that improves the coordination of salt loading from upstream point and nonpoint sources to manage a maximum load of salts that does not exceed water quality objectives
19	Urban Stormwater Runoff Management	Municipal Services	1. Coordinate efforts with agencies, stakeholders, and the public to decide how urban runoff management should be integrated into work plans. 2. Work with community to identify opportunities to address urban runoff management. 3. Provide incentives for the installation of low impact development features on new and existing developments. 4. Emphasize source control measures and strong public education/outreach efforts as being the most effective way to manage urban runoff in this highly arid region. 5. Increase community education efforts in coordination with organizations currently doing this work to include "drains to river" notification on storm drains and awareness programs for proper chemical disposal.
Objective: Practice Resource Stewardship			
20	Agricultural Land Stewardship	Agricultural Land Stewardship	1. Cultivate state payments for ecosystem services programs that compensate landowners for their stewardship while reducing the cost of regulatory compliance and delivering measurable conservation benefits.

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
			2. Maintain working lands employing conservation easement programs for wildlife, agricultural land, grasslands, forestlands, floodplains, and scenic and recreational open space, with preference for those that protect the highest priority resource lands and that protect lands conserving multiple values simultaneously. a. Educate landowners about the tax relief, estate planning, and other benefits of agricultural conservation easements. 3. Develop on-farm irrigation ponds and practices that provide off-stream capture of winter stormwater for summer use. Evaluate benefits for economic viability, local water supply, watershed management, flood control, groundwater recharge, mitigation of climate change, wildlife habitat, etc. 4. Implement promising agricultural practices and strategies that reduce net GHG emissions and increase carbon sequestration. 5. Create an inventory of soil organic carbon content. 6. Explore opportunities for farmer-to-farmer education, demonstration, and outreach on successful conservation programs. 7. For grant-funded projects, document project success and share lessons learned and successes with other growers. 8. Protect wildlife habitat on working lands to benefit pollinators and migration routes. 9. Stabilize stream banks and improve riparian forestation to slow bank erosion and filter drainage water from the fields. 10. Utilize proven or promising grazing, forest and brush management practices to reduce catastrophic wildfire risk, where appropriate. 11. Employ recreational opportunities that benefit preservation and sustainability of working/agriculture lands. 12. RCDs, Natural Resources Conservation Service (NRCS), Sierra Nevada Conservancy, Upper Feather River Watershed Group, UC Cooperative Extension and other public and private agencies should educate and support agricultural producers around grants and other incentives available to support agricultural strategies outlined in this plan. 13. Support development or continuance of agriculture-supportive and preservation language in county general plans, such as: a. Preservation of agriculture lands b. Encouraging new producers c. Right-to-farm ordinances

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
			d. Healthy locally produced food supply e. Support for farmers markets f. Public awareness of the value of agriculture, including educational curriculum g. Efficient agricultural permit procedures h. Supports for economic viability of agricultural producers i. Market supports for local agriculture products 14. Leverage local, state and federal agricultural conservation entity support for agricultural infrastructure investments, marketing assistance and land stewardship practices and strategies. 15. Develop alternative and/or flexible cropping systems/patterns for repeat dry-year scenarios and predicted decrease in overall snowpack and changes in precipitation patterns. 16. Develop channels for gathering and sharing ag-related climate change mitigation practices. 17. Manage working agricultural land to build or maintain carbon sequestration capacity, while maintaining productivity for food/fiber production.
21	Ecosystem Restoration	Floodplains, Meadows, Waterbodies	1. Create programs that support and fund the identification of stream flow needs. 2. Establish biological reserve areas that connect or reconnect habitat patches. 3. Expand riparian habitat. 4. Devise climate change adaptation plans that benefit ecosystems, water, and flood management. 5. Reproduce natural flows in streams and rivers. 6. Control non-native invasive plant and animal species. 7. Filtering of pollutants and recharging aquifers. 8. The protection and preservation of springs as water supply sources as well as valuable ecological and spiritual resources in the region. 9. Encourage a natural sediment transport regime through minimizing areas of excessive erosion and sedimentation and encouraging the transport of substrate through habitat restoration and changes in reservoir and hydrologic system management. 10. Remove barriers to fish migration in rivers and streams; assess culverts for adequate passage of aquatic organisms as appropriate.
		Uplands and Forest	Support work programs that: 1. Maintain and restore a diversity of historic habitats. 2. Connect and expand important habitat areas. 3. Protect habitats and habitat connectivity from catastrophic wildfire. 4. Protect riparian habitats and habitat connectivity from catastrophic wildfire.

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
			5. Protect habitats and habitat connectivity from catastrophic wildfire to maintain natural filtering of pollutants and for the recharging of aquifers. 6. Implement climate resiliency plans. 7. Benefit ecosystems, water, and flood management by protecting habitats and habitat connectivity from catastrophic wildfire. 8. Reintroduce managed fire where and when appropriate. 9. Restore the forest hydrograph. This can be accomplished by reducing unnatural, fire suppression-caused conifer densification and species imbalance, and thereby restoring natural base flows and pulse flows in streams and rivers. 10. Control non-native invasive plant and animal species. 11. Conserve springs as water supply sources. Springs are valuable ecological and spiritual resources in the region. Protect spring and wetland habitats from catastrophic wildfire. 12. Minimize areas of excessive erosion and sedimentation through implementation of Best Management Practices, watershed management, and through reduction of catastrophic wildfire. 13. Reduce road culvert barriers to fish and amphibian migration in rivers and streams by assessing culverts for adequate passage of aquatic organisms. Prioritize passage improvement work as appropriate.
22	Forest Management	Uplands and Forest	1. Support work programs that foster connections between forest management and restoring the surface and groundwater hydrograph in forested landscapes. Include integrated research and implementation projects for assessing: a. The effects of landscape-scale fuels reduction for enhancing beneficial uses of water b. The effects of vegetation and fuels management on soil moisture, groundwater recharge, and streamflows c. The quantification of both the short and long-term effects of prescribed fire water cycling and the cycling of soil nutrients d. The determination of the impacts of burn frequency and intensity on infiltration, percolation, surface runoff, and groundwater discharge e. The effects of different severity wildfires on water quantity, water quality, and aquatic organisms f. The role and magnitude of groundwater storage in mountain meadows and surrounding forests including effects on streamflows and flood flows g. The quantification of sediment sources and erosion processes in unmanaged, managed, and high-severity burned forests h. The effects of riparian forests in maintaining stream and groundwater hydrology, water quality

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
			and nutrient cycling. i. The habitat effects of different forest and meadow conservation strategies j. The effects of urban trees in reducing nonpoint source pollution k. The effects of managed forestland fuels in reducing GHG emissions from catastrophic wildfire l. The effects of high severity fire conversion of mature forests to brush fields, and the resulting effects on carbon sequestration, groundwater storage, and the volume and timing of streamflows m. The effects of brush field reburn cycles on carbon sequestration, groundwater storage, and the volume and timing of streamflows n. The regionally specific and pre-fire suppression extent of brushfields and mature forest habitats for specific forest species o. The effects of increasing conifer densities on the surface and groundwater forest hydrograph p. The short- and long-term effects of timely post-fire rehabilitation and restoration strategies. Evaluate effects on forest health, GHG emissions, water quality, and public safety 2. Support a program of work that includes monitoring and research on watershed trends. 3. Support the long-term monitoring needed to understand hydrologic changes resulting from climate change and management actions. Support more data collection stations in order to accurately determine how changes in hydrology and water quality are related to climate change and forest management activities: a. Additional stream gauges are needed throughout the forested regions of California to adequately represent the existing range of hydroclimatic and geologic conditions. In particular, gauges would be helpful in both managed and “pristine” watersheds b. Additional precipitation stations and snow courses are needed to increase the accuracy of determinations of climatic trends and evaluations of effects of management activities c. Additional water quality and sediment monitoring stations are needed to quantify the effects of climate change and forest management activities on surface water quality d. Additional long-term monitoring wells and aquifer infiltration, isotope, and recharge studies would be useful for understanding groundwater resources in forested watersheds e. Additional projects and studies to characterize regional surface water, groundwater and aquifer interactions on public, private, and tribal lands

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
		Tribal Advisory Committee	1. Increase landscape productivity by increasing ecosystem diversity and resilience through low and moderate intensity fire. 2. Increase landscape and climate change resilience through low and moderate intensity fire to increase fire succession mosaics. 3. Collaboratively develop projects and studies utilizing TEK as a monitoring tool of water quantity and quality over time. 4. Assess effects of fire succession in reducing invasive species and re-establishing fire adapted native species through collaborative projects and studies using TEK.
23	Land Use Planning and Management	Agricultural Land Stewardship	1. Develop or continue agriculture-supportive and preservation goals and strategies in county general plans, such as: a. Preservation of agricultural lands b. Encouraging new producers c. Right-to-farm ordinances d. Healthy locally produced food supply e. Support for farmers' markets f. Public awareness of the value of agriculture, including educational curriculum g. Efficient agricultural permit procedures h. Supports for economic viability of agricultural producers i. Market supports for local agriculture products 2. When conducting general plan updates, address relevant water management issues including water supply, water quality, water affordability, flood risk reduction, sedimentation and adequacy of services for residents. 3. Identify and assess groundwater recharge areas for groundwater supplies and limit development in those locations. 4. Plan for urban green zones, community gardens, school gardens, rainwater catchment, graywater and similar water conservation and management strategies. 5. Encourage compact and sustainable development patterns; discourage urban sprawl. 6. Collaborate with agencies and local governments to identify opportunities to maximize water conservation, groundwater recharge, stormwater capture, and other water management strategies that rely on local land use planning for effective implementation.

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
			7. Coordinate plan development among water management districts, flood control districts, RCDs, county and city governmental bodies, regional water masters, watershed managers, and others around water and related resource management strategies. 8. Continue use of the CEQA process to mitigate the significant impacts of new development on resources including agricultural land, wildlife habitat, open space, floodplains, recharge areas, wetlands, and water supply, among others.
		Floodplains, Meadows, Waterbodies	1. Increase communication between land use planners and water managers. 2. Plan for growth in a way that considers water resource features such as streams, wetlands, and groundwater recharge areas, water quality, and flooding. 3. Direct development away from undeveloped mountain meadows.
		Municipal Services	1. Plan for more compact and sustainable communities that will assist in reducing reliance on the state's water supply. 2. Plan for growth in a way that considers the availability of water supplies, water resource features, wetlands, groundwater recharge areas, and policies and regulations about water quality, drainage, and flooding. 3. Increase and enhance communication between land use planners and water managers.
		Uplands and Forest	1. Increase communication between land use planners and water managers. 2. Plan for growth in a way that conserves water resources such as streams, wetlands, springs, groundwater recharge areas, natural floodways, and water quality. 3. Direct development away from undeveloped mountain meadows, floodplains, and alluvial fans 4. Develop watershed information and strategies to update local land use decision makers on opportunities for maintaining and improving watershed functions
24	Recharge Area Protection	Floodplains, Meadows, Waterbodies	1. Restore and, where possible, protect meadows as recharge areas. 2. Encourage the preparation of and implement groundwater basin management objective plans to monitor and/or minimize water transfers to protect groundwater supplies and recharge zones. 3. Encourage science-based ecological restoration on public and private lands to maximize watershed function and recharge. 4. Identify and inventory actual and potential recharge areas throughout UFR Region.

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
25	Sediment Management	Agricultural Land Stewardship	1. Foster outreach and education on erosion and sediment management, new state requirements for irrigated land sediment management, and promising practices. 2. Evaluate strategies that manage fine solid fragmented material such as silt, sand, and clay, which is suspended in or settled on the bottom of waterbodies, for use in agricultural applications, wetland establishment and other beneficial re-uses. 3. Evaluate and coordinate management of agricultural water delivery systems for sediment build-up and mitigation needs. 4. Evaluate and manage areas such as dirt roads, burned areas, insufficient-capacity culverts and bare channels in the UFR that are susceptible to creating excessive sedimentation. 5. Remediate sedimentation of the Feather River and other Upper Feather River drainage dams. 6. Evaluate and plan for potential remediation of contaminated sediments.
		Uplands and Forest	1. The Natural Resources Agency and California Environmental Protection Agency should support an integrated approach to achieve the maintenance of stable watersheds where sediment yield mimics the natural sediment production that would occur in the absence of anthropogenic conditions. 2. Federal and state governments should support development of guidelines to identify when geomorphic assessments of streams for watershed stability are appropriate, to prevent undue delays in processing permits and ensure that studies are scaled to project size. 3. Where required, responsible agencies should utilize a common GIS mapping framework, and support sediment and flow monitoring programs. They should determine the sediment yields from a watershed and sediment budgets for downstream areas that include consistent monitoring protocols for scientifically defensible data of comparable quality throughout the state. 4. Post burn assessments and actions should include sediment and erosion remediation.
26	Watershed Management	Floodplains, Meadows, Waterbodies	1. Create a scientifically valid tracking and reporting method to document changes in the watershed. 2. Establish a scientifically valid means of tracking and reporting changes in the UFR Region's major sub-watersheds that provide reliable, current information to local communities, state and federal agencies, and others, regarding the net effects of management against the background of external change. 3. Restore and preserve stream channel morphology to provide floodwaters access to the floodplain and to encourage stable banks and channel form. 4. Assess the performance of projects and programs. 5. Provide watershed information to better inform local land use decision makers on how to maintain and improve watershed functions. 6. Use watershed approaches in which all RMS strategies are coordinated.

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
			7. Preserve habitats and ecosystems that provide functions essential to water management, including: a. Erosion prevention, healthy sedimentation levels, water temperature preservation, and the provision of a cold-water pool in the summertime b. Promote conservation of terrestrial and aquatic habitat connectivity c. Protect, preserve, and restore, where appropriate, the riparian zone 8. Identify where noxious weeds may become a serious problem for recreational use, water quality, ecosystem integrity, or other reasons, and manage those infestations accordingly. 9. Improve data collection and sharing among/between watershed stakeholders and outside entities. 10. Increase levels of community knowledge regarding their watershed and encourage responsible stewardship and protection. 11. Coordinate with and between stakeholders where appropriate. 12. Build regional capacity through stakeholder partnerships and collaboration. 13. Assess the connection between groundwater and spring and surface water sources to better understand their interactions. 14. Proactively address the recovery of special-status species, at both watershed and population scales, and incorporate measures to avoid future listing of other at-risk species. 15. Protect soil resources; restore the functions of drastically disturbed soils, to slow runoff and increase rainfall infiltration. 16. Retain intact floodplain and other wetlands, to the extent possible, to maintain or increase residence time of water in the watershed.
		Uplands and Forest	1. Support a work program for implementing projects that: a. Develop TEK tracking and reporting methods b. Create and maintain scientifically valid tracking and reporting methods to document hydrograph and precipitation changes in the watershed c. Establish scientifically valid means of tracking and reporting baselines and trends in watershed condition. Employ LIDAR and archival photo records to display and differentiate the net effects of management against the background of a more variable precipitation regime d. Restore and preserve stream channel morphology to provide access by floods to the historic floodplains e. Restore and preserve stream channel morphology to encourage stable banks and channel form for the regeneration of riparian vegetation

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
			f. Assess the performance of watershed projects and programs by integrating TEK and tribal restoration approaches with other metrics g. Develop landscape scale projects that coordinate multiple RMS strategies h. Maintain and enhance ecosystem functions in a changing precipitation regime i. Integrate peak flood attenuation with protecting habitats and migration corridors from catastrophic wildfire j. Advance the use of managed fire to enhance watershed function and resilience k. Assist property owners in implementing watershed management activities 2. Involve forest managers in integrated water and land management. 3. Develop science for informing the determination of objectives and strategies for forested meadows. 4. Use expanded interagency agreements to allow federal, state, tribal, and non-governmental agencies and entities to share expertise, staff time, and funding across jurisdictional boundaries for the purposes of landscape-scale watershed and water quality protection and improvement. 5. Use expanded interagency agreements where federal, state, and non-governmental agencies and entities share expertise, staff time, and funding across jurisdictional boundaries at landscape scales for the reintroduction of controlled fire and for the incorporation of tribal TEK. ● 6. Develop a science-based public education campaign directed at water users and communities in the Central Valley, Bay Area, and Southern California to increase support for forest management. ● 7. Develop integrated state and federal watershed resource enhancement and conservation climate adaptation plans for the forested headwaters areas and for urban forestry. 8. Involve federal agencies as partners with tribal, state, and local entities for grant programs, and allow federal funds and in-kind services to be used as grant matches. ● 9. Streamline vegetation and fuels management projects that reduce the risks of catastrophic wildfires with net beneficial effects on groundwater storage, surface water flows, and on water quality. 10. Work to reduce liabilities and other barriers to managed burning.
Objective: People and Water			
27	Economic Incentives	Municipal Services	● 1. Encourage regular examination and adjustment, where necessary, of water rates. ● 2. Encourage use of tiered rate structures. ● 3. Adopt policies that promote long-term water use efficiency.

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
		Uplands and Forest	1. Develop programs for supporting biomass utilization, enhancing groundwater recharge, reducing catastrophic fire, and reducing GHG emissions as integrated as essential elements of restoring forest ecosystem health across California's forestlands. 2. Develop TEK and other scientific evaluations for implementing such programs at the landscape scale in key watersheds of statewide importance. 3. Assist with developing the capacity of landowners and local organizations and programs to carry out RMS implementation. 4. Work with federal, state, and local legislators, agencies and entities, to reduce liabilities and other barriers to managed burning.
28	Outreach and Engagement	Agricultural Land Stewardship	1. Utilize both electronic and conventional media for outreach and engagement. 2. Engage public in creation of water and resource management plans. 3. Conduct outreach and education around available water management data sources; local agencies, their functions and contact information; and priorities from the UFR IRWMP. 4. Explore and coordinate common project goals and areas of need across organizations and agencies for more robust and integrated funding proposals. 5. Conduct outreach and engagement with stakeholders to advocate for policy change supportive of UFR IRWMP. 6. Conduct field trips, tours, and education projects and promising management practices for youth and adults. 7. Encourage use of the Ranch Water Quality Planning Short Course, which promotes the California Rangeland Water Quality Management Plan, to generate common understanding, discourse and action. 8. Develop opportunities for board leadership and management training for agencies and organizations in the UFR.
		Uplands and Forest	1. Support projects that incorporate outreach and education into project implementation. 2. Support and expand existing educational programs such as: tribal education programs; the Forest Institute Training for teachers "FIT" program; the "Learning Landscapes" program; the Butte County Fire Safe Council's 6th grade "fire aware" Charter School field training program; the Feather River Watercourse, "Plumas to the Pacific;" exemplary outdoor education programs offered to students (pre-school through junior college); and other entities in the UFR Region. 3. Support work with adjacent and downstream landowners to improve understanding of benefits that result from large scale and coordinated watershed projects.

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
29	Water and Culture	Tribal Advisory Committee	1. General Beneficial Use Goal: Beneficial uses of water include those that support fish consumption, aquatic and wildlife habitat for plant and animal species, recreation, and water quality and quantity to support such systems and activities. This includes those uses that support the cultural, spiritual and traditional lifeways of California Indian Tribes, Tribal communities and families. 2. TEK Goal: Integrate and apply Traditional Ecological Knowledge in collaboration with Tribes, Tribal organizations, and cultural traditional ecological practitioners. The UFR RWMG recognizes the ethical responsibility of project proponents to collaborate for the inclusiveness of the whole community and therefore to reach the Maidu family(s) with traditional responsibility to the project location.
30	Water-Dependent Recreation	Floodplains, Meadows, Waterbodies	1. Develop invasive species prevention measures. 2. Enhance the educational qualities of recreational activities throughout the region. 3. Work with a variety of stakeholders (USFS, power providers, educational institutions, non-profits) to identify recreational and educational opportunities. 4. Ensure that current and future recreational developments do not endanger water quality and/or environmental characteristics. 5. Develop a plan to resolve legacy pollution impacts on recreational waters. 6. Develop BMP guidance to reduce recreation-based water quality impacts, including impacts from recreational vehicles such as reduced pollution of marine engines and parking lot runoff. 7. Test surface water quality more often and make real-time water quality information for surface waters more accessible online and at recreation sites. 8. Educate residents and businesses in the watershed about their role in protecting water quality and recreational opportunities. Explain water quality issues to the public in more understandable and compelling ways. 9. Restore sustainable populations of native and/or game fish. 10. Maintain and restore vegetation along rivers and streams that support and enhance outdoor recreation. 11. Participate in the National Water Trails System.
31	Other Strategies	Agricultural Land Stewardship	1. Promote snow fences and/or windbreaks along roadways. 2. Reestablish historic wetlands where appropriate. 3. Explore rain-fed agricultural opportunities for UFR Region.

#	RMS	Workgroup of Origin	Workgroup Strategy Recommendations
		Uplands and Forest	1. Manage fire and fuels and strategically locate fire breaks for ridgeline lightning, roadway, and railroad ignitions. 2. Manage fire and fuels for the protection of critical habitats. 3. Manage snow zone fuels and fire. 4. Reduce wildfire liability. 5. Manage Wildland-Urban Interface (WUI). 6. Use Traditional Ecological Knowledge to reintroduce historic fire regimes. 7. Community recharge area management to protect domestic and agricultural wells from catastrophic wildfire and from reduced groundwater infiltration or excessive siltation. 8. All-scale biomass utilization, including community and tribal biomass projects. 9. Manage landscape-scale forest and fuels that include multiple fire and fuels management strategies.
	Wastewater/ NPDES	Municipal Services	1. Water/wastewater treatment: This resource management strategy potentially includes integration of agricultural and domestic wastewater into the water supply equation. Water/wastewater treatment has been a significant issue for the region's special district for several decades. a. Consider regional facilities b. Consider water/wastewater treatment as a supply option, through groundwater recharge and/or other means 2. Aging wastewater infrastructure and the need for upgrades to meet new and revised state standards. This strategy will also be important when considering water-recycling opportunities. Actions might include: a. Facility upgrades b. Assessment of private sewage treatment for safety next to wells in areas of semi-dense development (one-acre plots) c. Development of strategies for wastewater treatment to ensure the maintenance of receiving water quality 3. Infrastructure reliability: This strategy recognizes the importance of maintaining and upgrading infrastructure for water supply, treatment, and distribution; wastewater collection, treatment, and disposal; and recycled water treatment and distribution. Infrastructure improvements are continually needed as facilities age, demands on their use increase (due to population growth, degraded water quality, or increased water quality standards), and new technologies are introduced. 4. Provide regional operator training to enhance knowledge of wastewater collection, treatment, and disposal that will increase the certified operational pool in the area (succession planning). 5. Increase public outreach activities to promote the water and wastewater fields as career paths.

CHAPTER 7.0 LAND USE AND WATER PLANNING

7.1 Introduction

A goal of the Integrated Regional Water Management Plan (IRWMP) process is to facilitate communication between land use planners and water managers to better address coordination between land use planning and regional water planning. The IRWMP must incorporate and be consistent with local water and land use plans to encourage opportunities to implement local goals and policies; conversely, local planning documents should also incorporate IRWMP goals and objectives to provide collaborative opportunities with regard to IRWMP implementation.

One of the goals of the California Water Plan Update 2013 is to ensure water managers and land use planners make informed, collaborative water management decisions to better assure California's water needs are met into the future, especially in the face of climate change and drought. To address the integration of land use and water planning, the IRWMP must describe the relationship between the planning fostered by the IRWMP process—in this case, the Regional Water Management Group's (RWMG) planning efforts—and local agencies' 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.

7.1.1 Plan Area

Plumas County comprises 71.68 percent of the Upper Feather River watershed. Neighboring Butte (14.99 percent), Sierra (7.47 percent), and Lassen (5.2 percent) counties comprise the vast majority of the remainder of the Upper Feather River (UFR) IRWM plan Region. Only a small fraction of the Region (0.68 percent) is located within Shasta, Tehama, and Yuba counties (Table 7-1).

Table 7-1. County Acreages in the Upper Feather River IRWM Plan Area

County	Total County Size (acres)	Acres of County in Watershed	Percentage of County in Watershed (%)
Butte	1,072,692	345,850	14.99
Lassen	3,020,394	119,394	5.2
Plumas	1,673,682	1,653,456	71.68
Shasta	2,460,537	13,574	0.59
Sierra	615,880	172,367	7.47
Tehama	1,893,614	136	0.01
Yuba	411,973	1,880	0.08
Total Upper Feather River IRWM Region (acres)		2,306,657	100

Source: Deer Creek Resources, 2015.

Although the UFR IRWM plan area includes portions of Butte, Shasta, Tehama, and Yuba counties, it was mutually decided that they not be actively included in the UFR IRWM planning process for a variety of reasons: Butte County[1] because it is already entirely covered by the North Sacramento Valley IRWMP; Yuba County because it is entirely covered by the Yuba County IRWMP; and Shasta and Tehama counties because the land area covered by the UFR IRWMP in these counties is minimal and is managed primarily by Lassen National Park. This chapter, therefore, evaluates only those land managers within Lassen, Plumas, and Sierra counties. Further details on the Region are included in Section 7.2.1 of this chapter.

7.1.2 Watershed Characteristics

The UFR watershed is part of the northern Sierra Nevada, where that Range intersects with the volcanic Cascade Range to the north and the Diamond Mountains of the Basin and Range Province to the east. The tributaries of the Upper Feather River drain this terrain and flow southwest to eventually fill Lake Oroville, the second largest reservoir in the state. The Oroville Reservoir is the principal water storage facility of the State Water Project (SWP), which conserves and delivers water to over two-thirds of California's population (ESF 2005h). Water flows from Lake Oroville through canals to irrigate farms of the Central Valley and provide domestic water to Southern Californians, and also to the Lower Feather River and beyond to enrich the aquatic ecosystem of the Sacramento-San Joaquin Delta.

7.1.3 Water Supply

Water supplies in the Upper Feather River Watershed come from both surface and groundwater, with the majority from surface water. In Plumas County, 66 percent of supply water is from surface sources, with the remaining supply relying upon groundwater.[2] During drought years, additional groundwater is pumped to compensate for reduced surface water supplies. In Sierra County, a majority of supply water is from surface sources (94 percent).

The Region is the primary headwaters for the State Water Project (SWP), supplying 3.2 million acre-feet (AF) per year through Lake Oroville for downstream urban, industrial, and agricultural use. Lake Oroville is the largest of the SWP's storage facilities, with a storage capacity of 3.5 million AF of water; it accounts for 61 percent of the SWP's total system storage capacity and an important reservoir of the project. Developed municipal and industrial surface water supplies in California (DWR 2009b). The East Branch North Fork Feather River alone, which is contained completely in Plumas County, provides 25 percent of SWP water. Groundwater sources, both privately owned and publicly operated, occur mostly in the valleys on the east side of the Sierra Crest. Sierra Valley, the largest valley in the watershed, contains a large aquifer that is identified in DWR Bulletin 118 as a medium priority groundwater basin, thereby establishing it as subject to compliance with the recent sustainable groundwater management legislation.

7.1.4 Regional Land Use and Water Planning

7.1.4.1 Land and Water Managers in the Region

The Upper Feather IRWM Plan Area includes ten primary land managers (Table 7-2). Of these land managers, the counties and cities have the distinct and unique responsibility for planning land

[1] The UFR RWMG is working with Butte County representatives on an MOU for coordinating within the overlap area between the UFR IRWM and the Northern Sacramento Valley IRWM. The MOU stipulates coordination guidelines between the two entities for implementation projects located within the overlap area surrounding Lake Oroville.

[2] Supply water refers to all water uses including domestic, agricultural, and irrigation.

development policies and projects for privately held lands, which represent a small portion of the UFR Region. The US Forest Service/National Forests prepare land management plans and conduct land management activities such as restoration work and vegetation modification for fire protection, but do not plan for private development of land.

Table 7-2. Primary Land Management Agencies in the Plan Area

State of California	County of Sierra
City of Loyalton	County of Lassen
City of Portola	Lassen National Forest
County of Plumas	Plumas National Forest
Lassen National Park	Tahoe National Forest

7.1.4.2 Municipal Water Management

The Region includes 31 water managers (Table 7-3) responsible for managing water supply, quality, acquisition and delivery infrastructure, and administering the day-to-day operations of these activities. None of the water purveyors in the Region meet the DWR's definition of an urban water purveyor: one that provides over 3,000 AF of water annually or serves more than 3,000 urban connections. Urban water purveyors are subject to more stringent water conservation and reporting standards than are small water purveyors such as those in the Upper Feather River IRWM Plan Area.

Table 7-3. Water Purveyors and Managers in the Plan Area

Calpine California Water District	Chester Public Utility District
City of Loyalton	City of Portola
Clear Creek Community Service District	Clio Public Utility District
Dixie Valley Community Service District	East Quincy Community Service District
Feather River Canyon Community Service District	Gold Mountain Community Service District
Graeagle Community Service District	Graeagle Mutual Water Company
Greenhorn Creek Community Service District	Grizzly Lake Community Service District
Grizzly Ranch Community Service District	Hamilton Branch Community Service District
Indian Valley Community Service District	Johnsville Public Utility District
Lake Almanor Country Club Mutual Water Company	Last Chance Creek Water District
Long Valley Community Service District[3]	Plumas County Flood Control & Water Conservation District
Plumas-Eureka Community Service District	Quincy Community Service District
Sierra Valley Groundwater Management District	Sierra Valley Mutual Water Company
Sierraville Public Utility District	Walker Ranch Community Service District
West Almanor Community Service District	Westwood Community Service District

[3] Although Long Valley Community Service District doesn't currently provide water services, they could in the future.

Whitehawk Ranch Community Service District	Department of Water Resources[4]
Pacific Gas and Electric (PG&E)	Mill Race

The UFR Region also includes a number of agencies, Tribes and organizations that manage or otherwise have an interest in water management but do not purvey water. Other water stakeholders in the Region, identified as those entities that participate in water management activities and have a role in water management, are identified in Table 7-4.

Table 7-4. Other Water Stakeholders in the Plan Area

Water Manager/Stakeholder	Interest in Water Management
Plumas County Environmental Health	Regulates community wells; possible future monitoring of private wells
Sierra County Environmental Health	Regulates community wells; possible future monitoring of private wells
Lassen County Environmental Health	Regulates community wells; possible future monitoring of private wells
Feather River Resource Conservation District	Advocates conservation of soil, water, and natural resources
Enterprise Rancheria	Watershed management, fisheries and restoration activities within ancestral homelands
Greenville Rancheria	Watershed management, fisheries and restoration activities within ancestral homelands
Susanville Rancheria	Watershed management, fisheries and restoration activities within ancestral homelands
Maidu Summit Consortium and Conservancy	Watershed management, fisheries and restoration activities within ancestral homelands
Lassen County	Interest in water planning as it relates to land use planning
PG&E	Holds water rights for hydropower generation on area reservoirs and lakes
Plumas County	Interest in water planning as it relates to land use planning
Plumas County Community Development Commission	Interest in water planning as it relates to land use planning
Feather River Stewardship Council	Advocates forestlands stewardship through education and restoration for resilient watersheds
Feather River Land Trust	Forestlands, meadows and wetlands stewardship, conservation, and restoration; outdoor education including schools programs.
Sierra County	Interest in water planning as it relates to land use planning

[4] Department of Water Resources management activities include two water masters, one each for Indian Valley and Sierra Valley.

Water Manager/Stakeholder	Interest in Water Management
Sierra Institute for Community and Environment	Advocates for healthy watersheds and forests by developing assessments and programs in rural communities
Sierra Valley Resource Conservation District	Advocates conservation of soil, water, and natural resources
State Department of Water Resources	Headwaters of the State Water Project; leads IRWM planning process; Water Masters for Indian Valley and Sierra Valley
University of California Cooperative Extension, Plumas-Sierra and Lassen Counties	Research and education to address community challenges focused on sustaining agricultural vitality and enhancing natural resources
Plumas Watershed Forum	Funds implementation watershed management and restoration activities for the mutual benefit of Plumas County and the State Water Project
Plumas Corporation	Implement watershed restoration activities across the Sierra Nevada and including in the UFR Region.
Upper Feather River Watershed Group	Advocates irrigated lands stewardship through education and partnerships to ensure preservation of water quality
Resource Advisory Councils	As federal advisory committees, provides advice and recommendations to the National Forests on the allocation of Safe Rural Schools funding for natural resource improvement and wildfire protection projects in the Region.

7.1.4.3 Groundwater Management

Due to the complexity of the subsurface geology in the Region (Chapter 3 *Region Description*), the UFR watershed's groundwater basins are primarily located east of the Sierra Nevada Crest. Of the 14 groundwater basins in the region (UFR 2015b), the Middle Fork contains the largest in the Region, the Sierra Valley Groundwater Basin (ESF 2005i). The Sierra Valley Groundwater Basin is the only basin in the Region that is currently listed in DWR's Bulletin 118 as a medium priority groundwater basin requiring the development of a Sustainable Groundwater Plan (SGP) by 2023. Smaller groundwater basins located throughout the Region are relied upon by much of the Region's population, which utilize groundwater wells for domestic, municipal, industrial, and agricutlural irrigation needs.

The groundwater basins within the Region contain significant quantities of groundwater. In these areas, all of the municipal water purveyors except the City of Portola rely on groundwater for municipal/industrial water supply. Existing agricultural uses in these areas also rely on groundwater for some of their irrigation needs, typically more so during dry years when groundwater is used to augument or substitute for surface water irrigation. Groundwater is an important source for many water needs in the Region including rural homes' individual domestic wells, public and private agricultural and municipal water supply systems, and for sustaining surface water supplies and quality for water-based recreational uses and for environmental needs.

It is anticipated that new demand on groundwater supplies within Plumas County will be relatively minor (Plumas County 2012b). Groundwater is assumed to continue being the primary potable water source in

Plumas County. During prolonged droughts, increased demand on declining groundwater supplies could result in the decline of groundwater levels and/or quality within portions of the county. Particular areas which may experience declining groundwater quality or levels are those with expected growth (including Almanor, Mohawk, and the Sierra Valley) and areas having previously experienced groundwater declines during droughts, such as individual and community wells located in fractured rock zones. Groundwater recharge is an identified issue in the Region and is further discussed in Chapter 4 *Regional Water Issues*.

The Plumas County General Plan's EIR assessed the impacts of General Plan buildout on groundwater recharge and supply and found them to be a significant and unavoidable impact. Although increased demand on groundwater resources is expected to be relatively minor, the additional water demand of 2,066 acre-feet annually and resultant impacts on groundwater resources would be an irreversible consequence associated with the projected demand through 2035 (ibid). The 2035 Plumas County General Plan includes open space designations and policies for groundwater management, groundwater recharge area protection, groundwater demand reductions, conservation easements, and sustainable water practices. Specifically, Policy 9.1.1 supports the development and implementation of Regional groundwater management plans and protection of groundwater recharge areas from development, and encourages groundwater demand reduction where feasible.

Sierra Valley Groundwater Management District

Since its inception in 1980,[5] the Sierra Valley Groundwater Management District (SVGMD) has monitored groundwater levels and installed flow meters to monitor groundwater pumping on all wells in the Sierra Valley that pump 100 gallons per minute or more. The District periodically prepares Sierra Valley Hydrologic Studies, the most recent update occurring in 2015. In response to declining groundwater levels, the SVGMD established water budgets in the areas of significant agricultural pumping. The Sierra Valley Groundwater Basin is identified as a medium priority groundwater basin by the DWR, and as such is required to have a Groundwater Sustainability Plan (GSP) prepared and adopted by January 31, 2022 in accordance with the Sustainable Groundwater Management Act of 2014. The Region's remaining groundwater basins (with the exception of the Mohawk Valley Groundwater Basin) have no adopted groundwater management plans, groundwater ordinances, or basin adjudications.[6]

7.1.4.4 Agricultural Water Management

Agriculture in the UFR Watershed is a significant user of water, particularly in the Sierra Valley and Indian Valley. Farms, pastures and other agricultural entities obtain irrigation water from many sources, including both surface and groundwater resources. Accounting for nearly all of the agricultural lands within the Upper Feather River Region, Plumas and Sierra counties report approximately 62,000 acres of irrigated agricultural lands consisting primarily of grazing and hay lands (DWR 2015a). Because there are no agricultural water management entities that trigger the state requirements for Agricultural Water Management Plans (AWMP) (CA Legislation 2009), agricultural water management is typically dependent on private land owners. Department of Water Resources' Water Masters manage almost all agricultural

[5] The Sierra Valley Groundwater Basin Law (Senate Bill 1391, dated January 28, 1980) authorized the creation by joint exercise of joint powers agreements, district described boundaries for the purposes of groundwater management. The districts include the Sierra Valley Groundwater Basin (Sierra and Plumas Counties), and the Long Valley Groundwater Basin (Plumas and Lassen Counties).
[6] A draft groundwater management plan was prepared for the Sierra Valley Groundwater Basin by the Sierra Valley Groundwater Management District; however, it has not been formally adopted as of yet.

water provided by surface supplies in Sierra and Indian Valleys. Agricultural producers in the Indian and American Valleys have installed extensive water-efficient piped irrigation systems over the past ten years.

7.1.4.5 Tribal Water Management

Each of the Upper Feather River Tribes and Tribal groups exerts its authority to manage water according to traditional policies, laws, mandates, and capacity. Tribes are separate and independent sovereign nations within the territorial boundaries of the United States. This sovereignty is inherent and flows from the pre-constitutional and extra-constitutional governance of the Tribe. Tribal governmental structures recognize the sovereign and political independence of Tribal nations and their members; a right also recognized by the State of California. Pursuant to Executive Order B-10-11 (Brown 2011), the State recognizes and reaffirms the inherent right of these Tribes to exercise sovereign authority over their members and territory. The Region is the ancestral territory of Maidu Tribes who have an inherent responsibility for managing their ancestral territories. Therefore, Upper Feather River Tribes' jurisdiction goes beyond the gathering, fishing, and hunting rights, which each individual Tribal member retains.

7.1.4.6 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 with more than 500 units typically result in more land use planner/water purveyor collaboration due to the requirements of Senate Bills (SB) 221 and 610. Limitations of SB 221 and SB 610 are that the opportunity for land use and water supply planning collaboration is only applicable to large-scale residential developments, which occur rarely within the Region. SB 221 requires projects with more than 500 proposed dwelling units to obtain verification from the water purveyor that there is sufficient water to service the proposed project, as well as all other existing and anticipated future uses (such as 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) and must evaluate the water purveyor's supplies to meet existing and anticipated demands for the proposed project. Both of these statutes repeatedly identify the urban water management plan (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 (DWR 2003b). The only WSA prepared to date in the UFR IRWM Plan Area has been for the Lake Front at Walker Ranch development. In rural areas such as the UFR IRWM Plan Area, planning usually occurs at a smaller scale.

7.1.4.7 Flood Protection and Other Hazard Mitigation

Flood reduction, prevention, and mitigation are a challenge to residents and floodplain managers within the Region. Areas of the Region at risk of flooding include property near rivers and alluvial fans, and within valley floors. The Region's topography creates concentrated flows from high elevations that spread out into the valleys before again becoming concentrated in steep river canyons. Populations located within the valleys and along the rivers and tributaries in the canyons are particularly prone to floodwaters. Flood-prone areas within the Region include the Sierra Valley, Chester, Indian Valley, American Valley, Mohawk Valley, and the North Fork Feather River Canyon. Localized flooding associated with creek or stream overflow occurs in the Region when rainfall/snowmelt runoff volumes exceed groundwater recharge rates, the capacity of creeks and streams, and the design capacity of drainage facilities. Areas without flood control structures can experience localized flooding which can be exacerbated by warmer rain on snow events during heavy seasonal rainfall, which typically occurs from November through March.

200-Year Flood Protection Standards

New California flood protection standards under the Central Valley Flood Protection Program (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 Department of Water Resources has not yet mapped the 200-year floodplain within the Region, nor has FEMA. Consistent with Federal Emergency Management Act and Federal Insurance Rate Mapping requirements, Plumas County requires that new construction and substantial improvements of any structure shall have the lowest floor, including the basement, elevated at least one foot above the base 100-year flood elevation. Similarly, the General Plan policies of the County of Sierra, City of Portola, and City of Loyalton support protection of inhabited uses from the deleterious impacts of floods, while permitting compatible uses such as open space and recreation within floodplains.

7.1.4.8 Watershed Management

The Monterey Settlement Agreement (2003) was a settlement among numerous entities that authorized the establishment of a Plumas Watershed Forum to implement watershed management and restoration activities in the Plumas County portion of the Feather River watershed. Parties to the Agreement included the Planning and Conservation League, Plumas County Flood Control and Water Conservation District, Citizens Planning Association of Santa Barbara County, Inc., and the State of California Department of Water Resources, Central Coast Water Authority, Kern Water Bank Authority, and State Water Project Contractors. The Water Forum’s specific goals include:

- Improve retention (storage) of water for augmented base flow in streams
- Improve water quality (reduced sedimentation), and streambank protection
- Improve upland vegetation management
- Improve groundwater retention/storage

Another watershed collaboration, the Feather River Watershed Authority, was comprised of several entities and organizations: Plumas County, Plumas National Forest, Sierra Valley Groundwater Management District, and Plumas County Flood Control and Water Conservation District. These four entities had statutory authority in the Upper Feather River Watershed to oversee development of the 2005 Feather River Watershed IRWM Plan under a Proposition 50 planning grant and the development of the DWR Regional Acceptance Process, which were prerequisites for applying for IRWM Planning funds under Proposition 84.

Over the past several years, the Region has seen the completion of more than 50 watershed projects, including studies and assessments, stream restoration, monitoring, resource management plans, strategic planning, community outreach and educational activities that resulted from these efforts.

7.1.4.9 Stormwater Management

Effective stormwater planning and management on a regional scale involves collaboration of local, regional and Tribal governments, utilities, and other stakeholder groups to analyze the hydrology, storm drain/runoff conveyances systems, opportunity sites, and other habitat or community needs within sub-watersheds. Design of green infrastructure to capture dry weather or stormwater runoff should complement a regional planning for water quality conservation and protection of surface and groundwater. Coordinated stormwater management, monitoring, and evaluation over larger scales minimizes monitoring costs and maximizes the integration of stormwater monitoring with programs intended to protect beneficial uses.

The Storm Water Resource Plan (SWRP) Guidelines allow for an existing planning document or a collection of existing documents and local ordinances to be utilized as functionally equivalent plans, including but not limited to: watershed management plans, integrated resource plans, urban water management plans, green infrastructure plans, water quality improvement plans, salt and nutrient management plans, total maximum daily load (TMDL) implementation plans, or similar plans that include stormwater and dry weather runoff capture and use as a component of the watershed goals and objectives.

The watershed approach is essential to integrate stormwater management with other basic aspects of aquatic resource protection and overall water management such as flood control, water supply, and habitat conservation. The Water Code allows for a collection of local plans and ordinances and regional plans to constitute a functionally equivalent SWRP, if the plans and ordinances collectively meet all of the requirements of Water Code section 10560 et seq.

Proposition 1 Guidelines require an IRWM Plan to include any SWRPs developed for the Region. Per Water Code § 10562 (b)(7), the development of a SWRP and compliance with the provisions are required in order to be eligible for grants for stormwater and dry weather runoff capture projects with the following exceptions (SWRCB 2015b):

- Funds provided for the purpose of developing a Storm Water Resource Plan; or
- A grant for a disadvantaged community as defined in Section 79505.5, with a population of 20,000 or less, and that is not a co-permittee for [an MS4] National Pollutant Discharge Elimination System (NPDES) permit issued to a municipality with a population greater than 20,000. (Wat. Code, § 10563(c) et seq.)

There are currently no SWRPs within the UFR Region. However, should a SWRP be developed within the Region, the RWMG would incorporate it into the UFR IRWM Plan as an appendix and include the SWRP in the Data Management System.

7.2 Current Coordination between Land Use and Water Planning Entities

Land use planning is conducted within the Region primarily by the counties of Plumas, Sierra, and Lassen; the cities of Portola and Loyalton; the US Forest Service for the Tahoe, Lassen, and Plumas National Forests; Plumas-Eureka State Park; and regional Tribes. In general, counties have land use jurisdiction of unincorporated lands and cities for incorporated lands, with much of the public land administered by the national forests. (See 7.1.4.1 for a discussion of other land use managers within the Region.)

The integration of land use and water planning is becoming increasingly emphasized at all levels of governance, the need for which is particularly evident during droughts and emergencies such as wildfires within the wild and urban interface (WUI). To describe existing coordination between land use and water planning entities in the Region, water managers in the UFR Region were contacted for baseline data and other input. Information from the entities that responded is presented below.

7.2.1 Westwood Community Services District

Westwood Community Services District (CSD) reported that it coordinates with land planning entities on projects in Lassen County, where those projects are applicable to the CSD, and occasionally provides input at Lassen County Planning Commission meetings on projects that involve water supply or water quality issues. Westwood CSD does not have any water planning documents, which limits their ability to coordinate with land planning entities regarding potential water and district-related impacts.

7.2.2 Sierraville Public Utility District

The Sierraville Public Utility District (PUD) reported that it has very limited interactions with the Sierra County Planning Department because of its small service area (110 homes and businesses). Sierraville PUD recently commissioned a “Preliminary Engineering Study” for submittal with an application for a loan and grant from the USDA Rural Water Agency for a new water tank; no coordination with Sierra County’s planning agency occurred because the improvement would not result in land use or growth effects.

7.2.3 Plumas-Eureka Community Services District

The Plumas-Eureka CSD receives the agenda for the Plumas County Planning Commission and Zoning Administrator meetings for special use permits via email but has not provided input on projects to date. The CSD coordinates with Plumas County Local Agency Formation Commission (LAFCo) for annexations to the CSD. Water planning documents for the CSD include a Municipal Service Review, Preliminary Engineering Report for Arsenic Remediation, a groundwater management plan, and numerous Hydrological Reports on groundwater quality.

7.2.4 City of Portola

The City of Portola, an incorporated community that is both a land planning agency and water purveyor in Plumas County, provides water to its customers from springs, municipal wells, and surface water from Lake Davis through the Plumas County Flood Control and Water Conservation District. Portola’s Public Works Department coordinates with the Plumas County Planning Department on land use projects and provides input at city council meetings. The Public Works Department is not involved with Housing Element updates or any other general plan updates.

When project applications are received in the Region’s city and county governments, the respective planning departments notify 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.

All planning agencies must also comply with state requirements under SB 221 and SB 610 (see Section 7.1.4.6 *Water Supply Assessments*). For large subdivisions of 500 or more units, the applicant must work with the water provider that services the project to prepare a Water Supply Assessment (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 (Boeck and Hartman 2014).

7.2.5 Land and Water Use Patterns in the Region

There are no metropolitan areas within the watershed, and the population density is low (e.g., 7.2 people per square mile in Plumas County using US Census Bureau population statistics for 2013). The majority of people reside in small communities clustered around the population centers of Quincy, Chester, Westwood, Indian Valley, Greenville, Taylorsville, Crescent Mills, Almanor Basin, Portola, Sierraville, Loyalton, Chilcoot, Vinton, Beckwourth, and Graeagle. Plumas County accounts for the majority of population within the watershed, with a few small communities also occurring in the Lassen and Sierra county portions of the Region. A variety of land uses occur in the Upper Feather River Watershed. Of these land uses agriculture is predominant in alluvial valleys covering 3.5 percent of the total 2.2 million acres of the watershed (ESF 2005j). Forest lands and uses characterize over 70 percent of the UFR Region.

Plumas County

The vast majority of the Upper Feather Watershed Region is within Plumas County. In Plumas County, water covers two percent of the land base with over 1,000 miles of rivers and streams, hundreds of lakes, several reservoirs, and wetlands (Figure 3.5 *Map of vegetation communities in the Upper Feather River Region*). Riparian areas, which interface between aquatic and terrestrial habitats, comprise less than two percent of land cover and despite their ecological importance in the Region, are not identified for special management. However, public funding programs support their conservation and enhancement. In Plumas County, 62 percent of urban water use is for industrial and commercial uses; the remaining 38 percent is used for residential purposes. According to the 2035 Plumas County General Plan Land Use Element (Plumas County 2013a), the primary land use within Plumas County is open space, with approximately 94 percent of the total county area dedicated to timberland or other managed natural resource uses, including but not limited to recreation, mining, timber production, agriculture production, fisheries, and cultural and historic resources. The remaining six percent of the land area is reserved for uses such as residential, commercial, industrial, and public service (Plumas Co. 2013b). Land use patterns in Plumas County and other areas of the Upper Feather Watershed are largely reflective of the pre-automobile era, with developed uses clustered around transportation and resource hubs.

Sierra County

A majority of urban water use (75 percent) in Sierra County is residential, with the remaining 25 percent used for industrial/commercial purposes. According to the 1996 Sierra County General Plan, approximately 99 percent of the land within Sierra County consists of resource uses: open space (0.2 percent), forest (91 percent), water (0.8 percent), and agricultural lands (7.1 percent). Urban and community uses comprise only 0.9 percent of lands which includes seasonal residential/lodging (0.4 percent), and residential uses (0.3 percent). More than 71 percent of land in Sierra County is in public ownership: the Tahoe National Forest, Humboldt Toiyabe National Forest, and Plumas National Forest. Under the General Plan's buildout conditions, resource uses would decrease and urban uses would increase to 1.0 percent.

Lassen County

More than 63 percent of the land in Lassen County is administered by federal, Tribal, state, or local agencies. Lassen County's geographic area within the Upper Feather IRWM Plan Area includes portions of

Lassen National Park, Mountain Meadows Valley (a geographic region), and the unincorporated community of Westwood. Westwood is largely comprised of residential uses, while Mountain Meadows Valley predominantly consists of agricultural uses.

Cities of Portola and Loyalton

The only two incorporated communities in the Region are the cities of Portola and Loyalton, which have typical urbanized uses with a predominant mix of residential and commercial water users. Neither community has large industrial areas and agricultural uses are minimal. Because both cities are incorporated, all lands within the cities are under the planning jurisdiction of city government.

7.2.6 Population Growth and Water Demand Trends in the Region

Plumas County

Using California Department of Finance projections, the 2035 Plumas County General Plan Land Use Element estimates that the average population growth for Plumas County between 2010 and 2050 will be approximately 1.0 percent per decade. With this limited population growth in the Region, per capita water demand is forecasted to slightly increase if no conservation measures are implemented, and is expected to decrease if Best Management Practices (BMPs) and other conservation measures are adopted with guidance from the Urban Water Management Planning Act.

The 2035 Plumas County General Plan Update encourages growth within or near seven developed/developing Planning Areas in order to reduce impacts to agricultural production, natural resources, and public services, and provide a concise, orderly pattern consistent with the economic, social, and environmental needs of the specific communities that can accommodate future planned population growth. Orderly growth and development clustering are of the utmost importance in the efficient provision of public services and their attendant infrastructure. There are no planned large-scale infrastructure projects included in the General Plan (Plumas County 2013c).

Growth in the number of housing units in Plumas County has consistently exceeded the growth in the county's residential population during the past two decades. Between 1990 and 2000, the housing stock grew by 12.1 percent, or 1,444 units, while the number of resident households grew by only 10.8 percent during the same time period. These trends became even more marked during the nationwide housing boom between 2000 and 2010, when the Plumas County housing availability increased by 16.3 percent, or 2,180 units, even as the number of resident households dropped by 0.3 percent. Between 2000 and 2010 Plumas County experienced a 4.0 percent decline in population from 20,824 to 20,007 persons. Caltrans predicts that the number of housing units constructed within Plumas County will grow from 15,649 in 2010 to 20,606 in 2035. Caltrans predicts that the county's housing stock will grow almost three times as fast as its permanent resident population during the General Plan time horizon, implying that homes constructed for vacation use will represent a substantial portion of the overall residential construction. Based on the increment of new housing units projected by Caltrans for Plumas County, it is estimated that the county's overall housing stock will grow by approximately 5,000 new housing units between 2010 and 2035, an increase of about 200 units per year (Plumas County 2012c).

Sierra County

According to the 2006 Sierra County Housing Element, most of the development in Sierra County consists of single-family homes built by individuals. Large tract developments have rarely occurred in Sierra

County, though several small subdivision developments have been built, most of which have created no more than four parcels at a time. The Sierra County General Plan further notes that some areas in the county lack sufficient surface or ground water for development. In addition, there are areas where there may appear to be sufficient water but the potability is affected by heavy metals or minerals such as arsenic, mercury, sodium, chloride, and boron. Flood-prone areas also occur in Sierra County.

Four communities in Sierra County may have limited development potential due to either water quality issues or lack of capacity. For example, Calpine's public water system has limited capacity. Most of the county's population living in or near the various communities are served by one of the numerous public and/or privately owned water utilities.

The Sierra County Planning Department identified 17 individual water companies operating in the county, serving anywhere from 3 to 200 or more individual customers. In Sierra City alone there are nine different privately owned water companies. The remainder of the county's residents not connected to one of these public/private water utilities have either tapped into springs or surface water supplies, or have dug their own wells.

Lassen County

Westwood has a Westwood/Clear Creek Area Plan (2002) and a Westwood Revitalization Plan (2001) that envision residential, commercial, job, and recreational growth within the Westwood area. Land use maps were unavailable for Lassen County, though slow growth is projected for the area due to the distance from urban centers.

City of Portola


City of Portola, California

The total average water supply available to the City of Portola, located in Plumas County, is approximately 1.4 million gallons per day (mgd), with sources from Willow Creek Springs (312 gpm), the maintenance yard well (300 gpm), and the Commercial Street well (600 gpm). The city also has rights to four separate spring sources on Beckwourth Peak, south of the city – Turner, Malloy, Golden, and Darby – totaling 170 gpm or 270 AF per year. Development of these springs for future use would require improvements to collect the water below ground (below root level) and a new delivery pipeline system. The cost of such improvements is unknown, but is likely to be substantial relative to the amount of water that can be delivered (City of Portola 2012). The city stopped using the springs as a water source in 1971, after Lake Davis water became available. At that time the Lake Davis water was considered more reliable and subject to fewer potential health hazards. Lake Davis water is part of the State Water Project (SWP); Portola is the only recipient of SWP water within the Region. The water is managed by the Plumas County Flood Control and Water Conservation District, which is a State Water Contractor to the SWP.

In 1997, the California Department of Fish and Wildlife introduced poison into the lake in an attempt to remove the invasive Northern Pike fish, and domestic use of the lake water was subsequently terminated. In the following years, after numerous public hearings and the settlement of a lawsuit that resulted in an agreement to bring the Lake Davis Water Treatment Plant up to new Safe Drinking Water Act standards, the city and county entered into an agreement to work together to bring the plant back online. The plant is currently operational.

The City of Portola is an urbanized area of approximately 1,957 people with slow growth projected for the next ten years and increasing growth over the next 20 years. Approximately 400 acres of land south of the existing developed areas is anticipated for primarily residential development. Water supply issues associated with the ongoing drought are the city's foremost growth concern (Meacher 2015). The Portola General Plan indicates that the existing water supply and delivery system is adequate only for the existing community and that development anticipated in the Land Use Element would require an increase in the water supply and expansion and upgrading of the water storage and distribution systems. The City completed a Water System Master Plan in 2006 that addresses the water supply and distribution needs for the growth of the community (City of Portola 2012).

According to the Eastern Plumas Municipal Service Review, regionalization of sewer services in the Delleker/Portola area is a potential opportunity for facility sharing and regional collaboration. Joint efforts between Portola and Grizzly Lake Community Services District (GLCSD) may maximize efficiencies, reduce costs, and assist them to better leverage available resources (Plumas Co. LAFCo 2011). However, GLCSD (Delleker) is also exploring other options for water treatment facilities due to the costs associated with connecting to Portola's treatment plant.

City of Loyalton

The City of Loyalton, located in Sierra County, experienced a decline in population between 2000 and 2010 with negative annual growth rates for an overall loss of 12.4 percent of its population. The City had a 2014 population of 729. The City's historical growth rates and countywide growth rate projections by the Department of Finance and Plumas County Transportation Commission indicate minimal growth in the future. As of 2015, there were 21 residentially-zoned, undeveloped parcels totaling 9.96 acres within the city that could accommodate a maximum of 94 residential dwelling units (City of Loyalton 2015).

City of Loyalton, Sierra County (Source: www.loneliesttowninamerica.com)

7.2.7 Coordination with State and Federal Planning Efforts

Currently, Westwood CSD and other small water purveyors in the Plan Area work with the local office of the State Department of Public Health. Sierraville PUD is working with the USDA Rural Water Agency on funding and installing a new 200,000 gallon water tank. Sierraville PUD is working with the state on conserving water, implementing a drought ordinance, and developing an alternative water source. The City of Portola has adopted emergency regulations for water conservation in response to the State Water Board's recently adopted emergency regulations in May 2015. Plumas-Eureka CSD has little contact with state and federal agencies since they use groundwater as their drinking water source.

Ongoing collaboration with relevant federal and state agencies, Tribes, and other stakeholders, will continue after the IRWMP is finalized. Efforts will include coordination with DWR, California State Water

Resources Control Board, ongoing meetings with the Tahoe and Plumas National Forests and CALFIRE 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.

7.2.7.1 California Water Plan

The Upper Feather River IRWM Region is located within the Mountain Counties Overlay Area, which was newly identified in the California Water Plan Update 2013. The designation was actively promoted by the Mountain Counties Water Resources Association and the Sierra Water Workgroup, of which the UFR RWMG is a member. The designation recognizes the significance of the Region and importance of the Sierra Nevada mountain range to the local communities, the environment, the Delta, and all of California. The purpose of the overlay area is to collect and provide information that will better enable planners and decision makers to address issues in areas of special interest where the following criteria apply:

1. The area is of statewide significance — meaning that water management strategies and actions taken in one area affect much of the remainder of the state.
2. Common water management conditions exist in the area — meaning that issues and integrated planning opportunities span more than one of the 10 hydrologic regions.

Water is an essential element of the social, economic and environmental well-being in the Mountain Counties Area. It requires continued Area of Origin and County of Origin protections, healthy forests, and headwaters to ensure reliable water supply and high water quality for the Region and the entire state. The multiple benefits and services provided by the Mountain Counties Area to local residents, California, and beyond are often not recognized or easily quantified. In addition to water, the area provides habitat for thousands of species, many identified as endangered or rare. The area's forests and rangelands provide food, energy, timber, and other renewable resources that can be sustainably produced. The Mountain Counties Area also offers a unique service in helping to achieve statewide policy goals, such as reductions in GHG emissions, by storing large amounts of carbon.

Understanding the issues facing the Mountain Counties Region and making thoughtful, effective, and broadly supported changes is demanding. Land use management and planning in this rural region is complicated by the size and ownership of the land with myriad local, state, and federal agencies, and Tribes, governing everything from energy and infrastructure to environmental quality, species, and human health and safety. State and local interests that depend on the health of the Sierra watersheds and ecosystems of the Mountain Counties Area are as vast and diverse as the state itself.

A key vehicle for developing and implementing successful long-term management strategies for the region is a multi-stakeholder collaborative group such as watershed councils, fire safe councils, forest management collaboratives, water purveyors, and integrated regional watershed management groups whose members work across interests to achieve results. Stakeholder groups can increase statewide understanding of the Region's importance and support efforts to find viable financial and political solutions that address issues such as the lack of funding for projects to tackle localized resource issues critical to the entire state.

7.2.7.2 RWQCB Basin Plan

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 State Water Resources Control Board (SWRCB) carries out its water quality protection authority through the application of specific Regional Water Quality Control Plans, formulated and adopted by Regional Water Quality Control boards (RWQCB) that submit these plans to the SWRCB for review and approval.

The 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.

The SWRCB 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 most recently revised in 2009. The Basin Plan formally sets forth designated existing and potential beneficial uses and water quality objectives for areas, including the entire Upper Feather River IRWM region.

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, bio-stimulatory 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.

7.2.8 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 new subdivisions or industrial facilities) or land use policies (such as water conservation or landscape ordinances) can impact water supply and demand. Further, other projects, such as resource extraction or land clearing for new development, can impact water quality with regard to 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.

7.2.9 Plan Area Evaluated in the Upper Feather IRWMP

A substantial portion of eastern Butte County (345,850 acres) is an overlap area covered by both the Upper Feather IRWM Plan Area (Table 7-1) and the Northern Sacramento Valley IRWM. Because the entirety of Butte County is within the Northern Sacramento Valley IRWM Plan Area in which Butte has already participated, Butte County representatives did not ~~to~~ actively participate in the Upper Feather IRWM Plan Update. However, that does not preclude Butte County from participating in future Upper Feather River IRWM planning and implementation efforts. During the Draft Plan phase, Butte County expressed interest in future participation, particularly in coordination regarding any proposed projects that could affect Butte County within the overlap area. Some of the concerns expressed by Butte County representatives in the beginning of the Plan Update process was possible project funding conflicts between Northern Sacramento Valley IRWM and Upper Feather River IRWM regions, which are located in different IRWM Funding Areas. For these reasons, a memorandum of understanding (MOU) is being developed to outline the coordination between Butte County, and the UFR IRWM process.

The same situation occurs with Yuba County: The entire county is within the Yuba County IRWM Plan Area. That area's IRWMP was recently adopted in May 2015, so the 1,880 acres in Yuba County that overlap the Upper Feather River IRWM Plan Area were not included in the UFR IRWM planning effort.

Additionally, minimal portions of Shasta and Tehama counties are also within the Upper Feather IRWM Plan Area (13,574 and 136 acres, respectively). All those portions of Shasta County that are located within the UFR Region are lands managed by Lassen National Park. Within Tehama County, a small portion (approximately 40 acres) is privately owned by Collins Pine Company and is thus under the jurisdiction of Tehama County; a similarly sized area is managed by the US Forest Service Lassen National Forest. Because the area of land in Shasta and Tehama counties is minimal and is under federal land management, the project team made a conscious decision not to conduct outreach activities to their county planning agencies. However, the Lassen National Forest is identified as an advisory member of the RWMG and receives all IRWMP update information and notifications.

7.2.10 IRWMP Participation

Many entities were contacted during the Upper Feather River IRWM planning process (Tables 7-3 and 7-4); 53 of them have participated regularly (Table 7-5), either via RWMG membership or workgroup membership.

Table 7-5. Participation in the Upper Feather IRWMP Process

REGIONAL WATER MANAGEMENT GROUP	
Plumas County	Sierra Valley Groundwater Management District
Sierra County	Plumas County Community Development Commission
Plumas County Flood Control and Water Conservation District	Maidu Summit Consortium
Feather River Resource Conservation District	USDA Forest Service – Plumas National Forest (Advisory)
Sierra Valley Resource Conservation District	USDA Forest Service – Lassen National Forest (Advisory)
Public member from the Almanor Basin	USDA Forest Service – Tahoe National Forest (Advisory)
WORKGROUPS	
Agricultural Lands Stewardship Workgroup	
Plumas County	Sierra Valley RCD
UC Cooperative Extension	Feather River RCD
Plumas-Sierra Department of Agriculture	Feather River Land Trust
Mountain Meadows Conservancy	Plumas County Department of Agriculture
Plumas Sierra County Food Council	Upper Feather River Watershed Group
Floodplains, Meadows, Waterbodies Management Workgroup	
Mountain Meadows Conservancy	University California Cooperative Extension

Feather River Trout Unlimited	Plumas Corporation
Lindquist Environmental Consulting	Lake Almanor Water Group
Plumas County	Natural Resources Conservation District
Department of Water Resources	Plumas National Forest
Indian Valley Agricultural Producers	California Department of Fish and Wildlife
WM Beaty	Greenville Rancheria
Sierra Pacific Industries	Central Valley Regional Water Quality Control Board
Feather River Land Trust	Point Blue Conservation Science
Sierra County	Sierra Valley RCD
Trout Unlimited	
Municipal Services Workgroup	
Plumas-Eureka CSD	Clio PUD
City of Portola	Gold Mountain CSD
Plumas County Environmental Health	Sierraville PUD
Plumas County Public Works	Calpine
Plumas County Flood Control District	Greenhorn Creek CSD
Sierra County	Quincy CSD
Plumas County Community Development Commission	East Quincy CSD
Indian Valley CSD	Old Mill Ranch CSD
University of California Cooperative Extension	Chester PUD
Uplands and Forest Workgroup	
Plumas County	Lake Almanor Water Group
Plumas National Forest	Soper-Wheeler Company
Office of Emergency Services	Colllins Pine Company
Natural Resources Conservation District	Feather River Land Trust
Central Valley Regional Water Quality Control Board	Sierra Institute
Plumas County Fire Safe Council	Environmental Water Caucus
Maidu Summit Consortium	City of Portola
WM Beaty	UC Cooperative Extension
Tribal Advisory Committee	
Greenville Rancheria of Maidu Indians	Susanville Rancheria of Pomo Indians
Maidu Summit Consortium	Enterprise Rancheria
Note: The agencies and organizations identified as workgroup participants in this table are not necessarily signatories to the Memorandum of Understanding for the Upper Feather River IRWM Plan. However, member organizations of the RWMG are signatories.	

The Regional Water Management Group guides and oversees the development of the IRWMP, and forms the governance practices during and after IRWMP development. Based on their interest and focus, individual workgroups are responsible for developing Resource Management Strategies (RMS); however, all workgroups are responsible for development of land use planning and management RMSs. See Chapter 2 *Governance, Stakeholder Involvement, and Coordination*.

During the Upper Feather IRWMP Update process, many local entities have indicated that the IRWMP process has, for the first time, provided opportunities to coordinate between land use and water planning with other government agencies, Tribes and water districts. The IRWMP process has provided a unique forum, particularly in the Municipal Workgroup, to share information and problem solve. This IRWMP Update process has provided the first all-inclusive forum that includes small districts; these districts have reported that the workgroups and IRWMP process have been helpful for data sharing.

The project team for the IRWMP interviewed local land use agencies via phone and emailed a questionnaire to determine current interagency relationships and procedures. The US Forest Service and local jurisdictions of Plumas County, Sierra County, and the City of Portola are represented in the RWMG and the various workgroups, and have provided information for this chapter.

7.2.11 Programs, Policies, Standards, and Procedures

This updated Integrated Regional Water Management Plan includes a review of the water and land use planning policies, programs, and plans of other governmental and non-governmental (NGO) entities in the region (Table 7-6).

Table 7-6. Water and Land Use Planning Documents and Programs in the Upper Feather IRWMP Region

Water Managers	Documents and Programs
Plumas County Flood Control and Water Conservation District	Feather River Watershed Management Strategy for Implementing the Monterey Settlement Agreement (2004)
Sierra Valley Groundwater Management District	Sierra Valley Hydrogeologic Studies (2015) Results of the Fall 2005 Aquifer Tests in Sierra Valley (2006) Technical Report on 2005-2011 Hydrogeologic Evaluation for Sierra Valley (2012) Technical Report on 2012-2014 Hydrologic Evaluation for Sierra Valley (2015)
Land Managers	**Documents and Programs**
City of Loyalton	Housing Element (2015)
City of Portola	General Plan (2012) Parks and Recreation Master Plan (2010)
Feather River Land Trust	Feather River Land Trust Annual Reports (2004-2013)
Feather River Resource Conservation District	Long-range Workplan 2005-2009 (2004)
Lassen County	Lassen County, City of Susanville, & Susanville Rancheria Hazard Mitigation Plan (2010)

Water Managers	Documents and Programs
	General Plan (2000) Groundwater Management Plan (2007)
Lassen Local Agency Formation Commission (LAFCo)	Clear Creek CSD and Westwood CSD Municipal Service Review and Sphere of Influence (2013)
Plumas County	Hazard Mitigation Plan (2015) Emergency Operations Plan (2011) Hazardous Fuel Assessment and Strategy (2004) Communities at Risk Wildland Urban Interface Map (2010) General Plan Update CEQA Findings and Statement of Overriding Considerations (2012) 2035 General Plan Update Draft EIR (2012) 2035 General Plan Update (2013)
Plumas County Environmental Health	Plumas County Public Health Agency Environmental Health Division Annual Report 2010
Plumas County Community Development Commission	Community Action Plan (2014-2015)
Plumas County Local Agency Formation Commission (LAFCo)	Central Plumas Fire Municipal Service Review (2013) Eastern Plumas Municipal Service Review (2011) Indian Valley and Quincy Area Municipal Service Review (2015) Lake Almanor Area Municipal Service Review (2012)
Sierra County	2012 General Plan (1996)
Sierra LAFCo	City of Loyalton Municipal Service Review (2010)
Stewardship Council	Pacific Forest and Watershed Lands Stewardship Council Land Conservation Plan (2007) Status of Land Planning Efforts (2015) Stewardship Council Annual Reports (2005-2013)
Other Resource Managers and NGOs	**Documents and Programs**
Central Valley Flood Protection Board	Central Valley Flood Protection Plan (2012)

Water Managers	Documents and Programs
Department of Water Resources, California	Upper Feather River Flood Management Plan (Draft 2013) California Water Plan Update (2013) Bulletin 118 and related resources, pertaining to the Sacramento Valley Basin (2015) State Water Project documents (http://www.water.ca.gov/swp)
PG&E	Rock Creek - Cresta Project, FERC Project No. 1962: Rock Creek - Cresta Relicensing Settlement Agreement (2000) Upper North Fork Feather River Project, FERC Project No. 2105: Project 2105 Relicensing Settlement Agreement (2004); License stalled pending approval of 401 certification – Draft EIR has been released FERC Project 619 - Bucks Creek: Fish Entrainment Risk Assessment (2014) Bucks Creek Project Relicensing documents (2015) (www.bucksrelicensing.com) Lake Oroville Project Relicensing documents (2015) South Feather Power Relicensing documents (2015) Poe Hydroelectric Project Relicensing documents (FERC Project 2107) (2015) Project 2105 documents (2015)
Feather River Coordinated Resource Management Group	Coordinated Resource Management Plan for the East Branch of the North Fork Feather River (1989) Numerous technical studies (see Document Catalog)
Regional Water Quality Control Board	Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin Rivers (2009)
Sacramento River Watershed Program	The Sacramento River Basin: A Roadmap to Watershed Management (2010)
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) Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basin (2011)

Water Managers	Documents and Programs
US Forest Service	Tahoe National Forest Land and Resource Management Plan (1990) Plumas National Forest Land and Resource Management Plan (1988) Plumas National Forest: Forest Plan Monitoring Report (2012) Lassen National Forest Land and Resource Management Plan (1992) Lassen Land and Resource Management Plan Monitoring Report for FY 2005 and 2006 (2005 and 2006)
Sierra Institute for Community and Environment	2011 Lake Almanor Review: Survey of Water Quality, Trend Analysis, and Recommendations (2012) Lake Almanor Watershed Project (2015) Lake Almanor Watershed Management Plan (2009) State of the Almanor Basin Watershed Forum documents (2014)
Feather River Land Trust	Conservation plans for FRLT-owned lands and for conservation easements on private lands
Maidu Summit Consortium and Conservancy	Conservation and stewardship plans on lands identified for ownership in Humbug Valley and around Lake Almanor

The information, strategies, and policies in all applicable water management plans have been incorporated in this chapter and elsewhere throughout the IRWMP Update. As these plans are updated, the revised versions will be reviewed and considered in subsequent IRWM planning efforts. As discussed in Chapter 5 *Goals & Objectives*, the goals and objectives of this IRWMP are consistent with local water plans. Most purveyors of agricultural water in the region are not included in Table 7-6 because they have not adopted planning documents.

The Upper Feather IRWMP Update incorporates local water resource management planning documents and information from groundwater management plans, adjacent IRWMPs, and local general plans. A brief description and background of several relevant water plans reviewed during the UFR IRWMP Update follow, along with their jurisdictions, how they apply to the IRWMP, and the compatibility of and dynamics among the IRWMP, the water plans, and the land use plans. The Plumas County General Plan EIR incorporated the IRWMP by reference and now includes a discussion of the IRWMP planning process in the Hydrology, Water Quality, and Drainage section of the EIR.

7.2.11.1 US Forest Service Land Use Plans

US Forest Service (USFS) planning documents provide guidelines and management direction for the Upper Feather 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 (USFS 2012a) for land management planning for the National Forest System became effective on May 9, 2012. The Forest Service has subsequently released final planning directives (USFS 2012b) that are the key set of agency guidance documents that direct implementation of the 2012 Planning Rule.

The Forest Land and Resource Management Plans for Plumas (1988), Lassen (1992), and Tahoe (1990) National Forests direct 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 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 that are 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.

Monitoring reports for the Lassen and Plumas National Forests are also available from the Forest Service and document the successful implementation of their forest plans, such as the 1999 Herger Feinstein Quincy Library Group Record of Decision, the 2004 Sierra Nevada Forest Plan Amendment, and the 1994 Northwest Forest Plan Amendment as amended in 2001 and 2004.

The Sierra Nevada Conservancy's 2014 report "State of the Sierra Nevada's Forests" outlines key findings that include, "science-based ecological restoration of our Sierra Nevada forests must be dramatically increased in order to stem the tide of large, uncharacteristic wildfires." This key finding will likely be a guide to policy development within USFS land.

7.2.11.2 California Environmental Quality Act

Development projects are subject to CEQA, which requires consideration of potential environmental impacts of the 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. While the IRWM Plan itself is not subject to CEQA, project sponsors will be required to comply with CEQA and prepare an evaluation to assess the physical impacts of their projects upon implementation grant application.

7.2.11.3 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. Plumas County and Sierra County have both chosen to participate in the Williamson Act (Dept. Conservation 1965). Lassen County still participates in the Williamson Act, but to a more limited extent and with more stringent requirements for enrollment (Lassen Co. Coop Ext 2012).

7.2.11.4 LAFCo Municipal Service Reviews

In 2000, California adopted the Cortese-Knox-Hertzberg Act (AB 2838) requiring Local Agency Formation Commissions 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, a LAFCo must comprehensively review municipal services within the affected jurisdiction(s). A Municipal Service Review (MSR) covers an analysis and determinations on the adequacy of service for 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.

The following MSRs were completed in the Upper Feather IRWM Plan Area and are applicable to this IRWMP:

- Eastern Plumas MSR (October 3, 2011)
- Central Plumas Fire MSR (December 9, 2013)
- Lake Almanor Area MSR (October 15, 2012)
- City of Loyalton MSR (December 9, 2010)

Within each of these adopted MSRs is a list of determinations related to the existing and future provision of public services in their respective service areas. Determinations related to water issues in the region are highlighted below.

City of Loyalton MSR

- "There is sufficient source water available to serve the expected population growth."
- "The City of Loyalton should do everything possible to meet the requirements of the Central Valley Regional Water Quality Control Board and avoid costly fines."
- "The City is working to correct deficiencies in its WWTP and Collection system."
- "The City of Loyalton wastewater treatment plant is being improved to meet the requirements of California Regional Water Quality Control Board, Central Valley Region Order No. R5-2009-0108 Waste Discharge Requirements for City of Loyalton and Grandi Ranch Wastewater Treatment Facility Sierra County, dated October 8, 2009."
- "The improvements in the Loyalton wastewater treatment plant are being made to correct problems noted in the Cease and Desist Order No. R5-2005-0089."
- "The City of Loyalton has increased wastewater fees to pay for the required improvements to the wastewater treatment system."

Eastern Plumas MSR

- "There is a general lack of tracking of demand and other service indicators, which inform remaining capacity and level of services, in particular for water [. . .]"
- "With the exception of Gold Mountain and the City of Portola, the connections throughout the other water systems are unmetered. In order to accurately gauge the remaining capacity of the systems and determine the exact rate of water loss, it is recommended that water providers begin installing meters as financing allows. Meters will also enable agencies to charge water rates that promote water conservation."
- "All of the potable water providers presently rely on groundwater from wells and springs. The City of Portola will be transitioning to a surface water source once the new Lake Davis Water Treatment Plant is online and operational." *Update: the Treatment Plant is now operational.*

Central Plumas Fire MSR

- "Crescent Mills Fire Protection District reported a lack of available water in the District as a major challenge. Except for within the Crescent Mills community, the water for fire suppression has to be hauled."
- "The Greenville water system continues to need substantial improvements to reduce significant unaccounted for water loss [50% in 2012 due to breaks and leaks]."
- "Quincy Fire Protection District cited absence of a sufficient water system as a capacity constraint for the District."

Lake Almanor MSR

- "All of the potable water providers presently rely on groundwater from wells and springs, much of it from the Lake Almanor Valley groundwater basin."
- "Chester PUD was unable to provide an estimate of what portion of water is lost between the water source and the connections served."
- "Hamilton Branch Community Services District reported approximately 47 breaks and leaks per 100 miles of pipe lines in 2011, while other providers in the region had a median rate of 11 breaks per 100 pipe miles."
- "Walker Ranch CSD estimates that the loss rate is approximately 16 percent during peak usage months (May through October), and no loss during winter months (November through April) between the water source and the connections served. Average water loss in the region is 12 percent."

A general theme among these MSRs was that consolidation of water suppliers could result in conservation of water resources but, as in many rural areas, consolidation is largely infeasible due to the isolated geography of the service providers. Lake Almanor and Central Plumas special districts had specific infrastructure maintenance issues such as excessive leak and break rates, while Eastern Plumas districts reported a lack of tracking and metering that resulted in inadequate data on supply and demand. The limited availability of data has made compliance with state-mandated conservation targets difficult to assess.

These determinations support the RWMG objectives that emphasize the need for collaboration between land use and water planning due to uncertainties of water supply into the future. Because the Cortese-Knox-Hertzberg Act requires MSRs to be updated every five years, there is opportunity for coordination regarding MSR determinations and IRWM objectives, including participation in the MSR process by IRWMP adoptees.

7.2.11.5 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 region warrants discussion for their positive impacts on the local watershed. The Feather River Land Trust (FRLT) is the major land conservancy group in the Upper Feather River watershed. To date, the FRLT has helped to conserve over 36,000 acres of private lands that promote valuable watershed goals, including recreational opportunities, educational opportunities, cultural sites, agricultural lands, and waterway and habitat preservation. The FRLT conserves land by means of conservation easements on private properties and fee title acquisition. The FRLT owns five properties:

- Folchi Ranch, Sierra Valley – 331-acre property purchased in 2014, which contains extensive seasonal and permanent wetlands, open water, and upland sage brush habitat
- Maddalena Property, Sierra Valley – 575-acres purchased in 2003, which contains freshwater wetland and marsh habitat
- Leonhardt Ranch Learning Landscape, American Valley – 42-acres purchased in 2012 and used as a living classroom for youth; habitats include meadows, riparian and wetlands
- Heart K Ranch, Genessee Valley – 900-acre ranch purchased in 2006, which contains woodlands, meadows, and riparian habitats and supports 26 species of concern
- Olsen Barn, Almanor Area – 107-acre property purchased in 2015, which is being preserved for wildlife habitat, recreation, and cultural heritage
- The Bulson Ranch – 1,630-acre ranch acquired in 2016, which contains freshwater wetlands and marsh habitat

Numerous conservation easements on agricultural lands are also held by the California Rangeland Trust and partnerships. The Sierra Nevada Conservancy is another conservation partner in the region.

Another conservation group in the region is the Maidu Summit Consortium and Conservancy, which is in the process of acquiring lands for ecological and cultural conservation and education including portions of Humbug Valley as well as portions of land around Lake Almanor and along State Route 89 near Lake Almanor in Plumas County.

The Natural Resource Conservation Service (NRCS) also conserves the productivity of private working agricultural and forest lands through its programs. For example, through its Wetland Reserve Program (WRP), the NRCS established conservation easements on hundreds of acres in Plumas and Sierra counties.

Land conservation is consistent with local land use planning documents, including the 2035 Plumas County General Plan Update and the Sierra County General Plan. Goal LU 1.11 of the Plumas General Plan is “to promote development patterns that recognize the need to conserve water resources, consistent with other stated goals,” while Goal 7.1 is “the conservation and utilization of natural resources, including water and its hydraulic force, forests, soils, rivers and other waters, fisheries, wildlife, minerals and other natural resources and protection of open space land for the continuation of the County's rural character; scenic beauty; recreation; the protection of natural and cultural resources; and as consideration of open spaces as an important factor in the County’s quality of life.” The Water Resources Element goal in Sierra County’s General Plan is to “protect and maintain its water resources for the benefit of County residents and natural habitats and to assure protection of its watersheds as a primary land use constraint.” Sierra County’s General Plan has goals related to conserving timberlands, agricultural lands, fisheries, wildlife, and related natural resources.

7.2.11.6 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 a county's constitution for the physical use of its 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 IRWMP.

These local jurisdictions within the Upper Feather IRWM Plan Area have prepared general plans:

- 2035 Plumas County General Plan (December 2013)
- 2012 Sierra County General Plan (1996)
- 2000 Lassen County General Plan (2000)
- City of Portola General Plan (January 11, 2012)
- City of Portola Parks and Recreation Master Plan (June 1, 2010)

Most general plan updates (other than the Housing Element) are updated once every 20 years, on average. As the general plans are updated, there will be opportunities for collaboration among 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 occur with the adoption of new or revised zoning ordinances, which often implement the goals and objectives of the general plans.

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 a local jurisdictions' zoning or municipal ordinances, are the on-the-ground implementation measures used to enact these protections.

7.2.12 Consistency between IRWMP and Local Plan Goals

Local planning goals and policies were reviewed to ensure that the goals and objectives of the Upper Feather River Integrated Regional Water Management Plan are compatible with and support local planning efforts (Appendix 7-1). These documents were reviewed to support development of the Upper Feather IRWMP's updated objectives and projects.

In general, the goals and objectives adopted by the Regional Water Management Group are closely aligned with local general plan goals and policies. For example, the RWMG found that the need to "reduce [the] potential for catastrophic wildland fires in the Region" while "balanc[ing] the needs of forest health, habitat preservation, fuels reduction, forest fire prevention, and economic activity" were important objectives. All of the local general plans also include goals and policies closely related to these RWMG objectives (e.g., City of Portola General Plan Goal WF-1, Lassen County General Plan Goal N-10, and Plumas County General Plan Goal 6.3). "Build[ing] communication and collaboration among water resources stakeholders in the Region" were also found to be important objectives for the Upper Feather region and, again, all of the local general plans support collaboration with other local, state and federal entities (e.g., Plumas General Plan Policies 7.1.3, 7.2.18, 9.2.4, 9.2.7, 9.7.6, 9.9; and Sierra County Parks and Recreation Element Policy 3, Water Resources Element Policies 14, 17, 21, and Energy Element Policy 3).

Many of the older general plans do not contain specific policies on climate change. However, Plumas County's General Plan does contain numerous policies on energy efficiency in its Economics Element, as well as carbon sequestration, biomass energy, and sustainable agriculture policies (Policies 7.10.2, .4, .6, 9.3.1 and 9.3.2). The RWMG goals and objectives are not specific with regard to range land and timber land objectives as are many of the local general plans and policies. However, the RWMG goals and objectives are broad enough to include these issues, as in the objectives calling to "Maximize agricultural, environmental and municipal water use efficiency" and "Balance the needs of forest health, habitat preservation, fuels reduction, forest fire prevention, and economic activity in the Upper Feather River Region."

Local planning policy documents support the overarching IRWM planning concepts of regional coordination among various land and water planning entities, as well as enhanced management of water that leads to greater conservation. All of the area general plans support the concept of focusing growth in areas that can readily provide public services and infrastructure, and support conservation of fisheries and water resources. The Plumas County General Plan specifically supports regional water management efforts and watershed program funding via Policies 9.4.4 and 9.4.5. Plumas County General Plan Policies 9.1.1-9.1.3 and 11.1.1 support regional groundwater planning consistent with the RWMG objective to "coordinate management of recharge areas and protect groundwater resources." Water conservation is also a specific goal of the Plumas County General Plan (Goal 9.8), consistent with the RWMG objective to "maximize agricultural, environmental and municipal water use efficiency."

All local plans and the IRWMP support goals of enhancing water quality, flood control infrastructure, and water supplies that support recreational uses while minimizing impacts on water quality and offer multiple benefits such as recreational, ecosystem, and agricultural benefits.

The ability to meet growing demands for water in the face of possible declining water supply due to climate change was a common theme in local general plans, particularly the City of Portola General Plan Policy PF-P-5 (supporting additional supply); Lassen County General Plan Policy NR-16 (supporting surface water rights), Goal N-5, Policy NR-21 and NR-22 (supporting the development of new reservoirs and other water supplies); Plumas County General Plan Policy 9.5.5 (supporting water rights); and Sierra County General Plan Water Resources Element Policies 1, 2 and 3 (supporting water rights) and 23 (opposing new diversions or impoundments that would limit Sierra County's supply).

Protecting and improving water supply reliability is also a major goal of the RWMG. However, as seen in Sierra County's Water Resources Element Policy 23, new diversions or impoundments intended to bolster one local jurisdiction's supply can harm another jurisdiction's supply downstream. Regional water planning needs to balance growing water demands in the context of existing water uses, contracts and rights. The RWMG may wish to consider further discussions not only of increased surface water supplies but also opportunities for the conservation, enhancement, and coordinated management of groundwater and surface water.

None of the local general plans contain specific policies relating to water that "address water resources and wastewater needs of Disadvantaged Communities (DACs) and Native Americans" which is an RWMG objective. Future general plan updates should consider highlighting needs and services relating to DACs and Tribal entities during the planning process and in the Plan.

7.3 Plan in Relation to Neighboring Regional Planning Efforts

Seven IRWM planning areas are directly adjacent to the Upper Feather River Integrated Regional Water Management Plan region: Lahontan Basin, Upper Pit River Watershed, Upper Sacramento-McCloud, North Sacramento Valley Group, Yuba County, Cosumnes American Bear Yuba, and Tahoe-Sierra. During the preparation of this Plan, collaboration with these regions occurred primarily through informal contact, conferences, workshops, and working groups (e.g., Sierra Water Workgroup). The various regional representatives will continue to coordinate with the Upper Feather IRWM via scheduled meetings at least annually, phone conversations as needed, attendance at RWMG meetings as requested, and through casual meetings at regional events and conferences such as the Sierra Water Workgroup, the Association of California Water Agencies, and attendance at DWR-sponsored workshops. Issues of common concern include forest management, flooding, water supply, fisheries, climate change, and capacity challenges. The adjacent regions have not yet begun to systematically focus on the options for inter-IRWMP project development coordination. More information on next steps in regional collaboration is contained in Chapter 2 *Governance, Stakeholder Involvement and Coordination*.

7.4 Recommendations to Improve Coordination

As described in Chapter 2 *Governance, Stakeholder Involvement and Coordination*, at the outset of the IRWMP Update process, stakeholders with an interest in the region's water issues were identified through various outreach and engagement strategies. During subsequent interviews and meetings with interested stakeholders who became part of the Regional Water Management Group, the project team was able to identify regional issues and water-related conflicts. The contacted water agencies identified many similar water management issues such as water supply reliability, groundwater aquifer level sustainability, water quality improvement (with some purveyors experiencing heavy metal contamination), aging infrastructure, and flood management. Recent curtailment orders from State Water Board due to the ongoing drought also present significant and new water management challenge that necessitates not only ongoing education about conservation and water demand management, but also ongoing coordination and sharing of information and resources among water and land use planners, and as needed, with the Office of Emergency Services (OES) during extreme weather events such as floods. During the 2014-2016 drought, needs assessments were coordinated between land and water use agencies and emergency response entities through the Plumas and Sierra Counties Drought Task Force.

During the development of this Water and Land Use chapter, all of the water and land use planning entities in the Upper Feather Plan Area were contacted. Plumas County and the City of Portola responded to requests for information and input, but the remaining land planning agencies did not respond. Of the 31 water agencies in the region, three responded. However, many of those that did not respond are active participants in the RWMG or workgroup meetings. The RWMG meetings are formatted to elicit discussion and problem-solve emerging issues. They appear to be an important and effective tool in creating a convergence point for future collaboration, and will continue to be so during annual meetings throughout the IRWMP implementation process. Outreach will continue to Lassen County, Sierra County, and the City of Loyalton to engage these agencies in conversations about water and land use planning issues via the RWMG and the featherriver.org website. To provide effective outreach, the RWMG could consider one-on-one meetings with representatives the non-participating entities. Routine email communication to all water and land use planning entities with grant and other funding opportunities for water-related projects should also continue. Sierraville PUD in particular has noted that as an all-volunteer board, the PUD misses opportunities for funding, modernization and development because of their lack of expertise. Funding for a paid consultant, grant writer, or advisor could dramatically improve coordination between the PUD, other local water purveyors, and land planning agencies.

Most of the responding water managers, including Westwood CSD, Sierraville PUD, and Plumas-Eureka CSD, reported little to no coordination with land planning entities on current planning projects (those individual projects currently proposed), and virtually no coordination on long-range planning or policy-level documents that can impact growth and water demand, such as Housing Element and General Plan updates. It is recommended that the land planning agencies in the Upper Feather IRWM region, particularly those agencies that encompass multiple water agencies, such as Plumas, Lassen, and Sierra counties, include their local water purveyors in all land planning efforts. Consistent with the Ahwahnee Principles for Resource Efficient Land Use (Calpthorpe 1991), which advocate a more proactive relationship between land use and water management, coordination efforts should include,

1. distribution of land use project application materials to water purveyors, when applicable, as well as
2. enhanced outreach to these small water purveyors during long-range, strategic, and policy-planning efforts.

At the same time, small water suppliers should also coordinate with the local land planners when conducting water planning and management activities that could affect growth and land use patterns. For example, local land planning agencies and Tribes should be informed when the water purveyor is planning additional water storage or conducting floodplain management or floodway improvement activities.

A significant issue related to emergency drought curtailments of surface waters and from springs to DAC households and communities without access to other water sources remains unresolved. The City of Portola and Sierra and Plumas Counties provided extensive comments during the drought water curtailment process. Tribes in the region have identified the conservation and enhancement of springs as a region-wide tribal water and land use priority.

Coordination among the land and water managers of the Upper Feather region will be enhanced in the future by continued participation on the RWMG and by the Upper Feather IRWMP website (http://featherriver.org)). Opportunity for ongoing coordination include shared equipment (such as specialized equipment used in wastewater and water treatment processes), shared knowledge (such as groundwater management plans and studies or GIS mapping efforts), and routine meetings to discuss potential grant funding opportunities and planning occurring in the area. A general theme among the region's MSRs was that consolidation of water suppliers would likely result in conservation of water resources, but that due to the rural nature of the water providers, physical consolidation was largely infeasible. The RWMG should take advantage of future planning document updates (General Plans, Area Plans, MSRs, Housing Elements, National Forest Land and Resource Management Plans, etc.) to coordinate IRWM and local and regional plan objectives related to water planning. RWMG members encourage participation in local and regional planning processes to ensure that future plan updates consider all potentially impacted areas and communities, including DACs and Tribal entities during their planning processes.

Prior to the IRWMP process, coordination among the larger land use and water planning agencies was functional, with reviews of new developments distributed to water agencies for review and input. However, the IRWM Update process has provided a unique opportunity for smaller, more isolated water purveyors often serving DAC communities to communicate and coordinate with other water and land use planners.

CHAPTER 8.0 CLIMATE CHANGE

8.1 Introduction

The act of planning requires an estimate of future conditions. Traditionally, resource managers have assumed that the past is a good indicator of the future, and have used historical measurements as best estimates for future conditions. Per Proposition 84, Proposition 1, and California Department of Water Resources (DWR) requirements, this chapter considers an Upper Feather River (UFR) watershed that, as a result of climate change, may have substantially different climate conditions than historically witnessed in the planning area.

This chapter begins with a description of climate change regulations and requirements related to the integrated regional water management planning process, as well as an overview of the resources used to support chapter analysis and findings. The chapter then provides a brief explanation of how temperature and precipitation could change in the planning area, and how those changes could cause regional impacts. Based on these impacts, the chapter provides the findings of the climate change vulnerability assessment. The chapter concludes with a prioritized list of vulnerabilities in the planning area and a description of how climate change is integrated into the plan's resource management strategies and project selection process.

8.1.1 Regulatory Framework

The primary guidelines for the Upper Feather River Integrated Regional Water Management Plan (IRWMP) are in the DWR's Integrated Regional Water Management Proposition 84/1E Guidelines (DWR 2012) and Proposition 1 Guidelines (DWR 2016). DWR's guidelines establish the general process, procedures, and criteria to implement the IRWMP Implementation Grant Program, funded by Proposition 84 (The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006) and the related Stormwater Flood Management Grant Program, funded by Proposition 1E (The Disaster Preparedness and Flood Protection Bond Act of 2006). The guidelines present 16 IRWMP Standards. Standard 16 (Climate Change) notes:

> *The IRWM Plan must address both adaptation to the effects of climate change and mitigation of GHG emissions. The IRWM Plan must include the following items:*
>
> – A discussion of the potential effect of climate change on the IRWM region, including an evaluation of the IRWM region's vulnerabilities to the effects of climate change and potential adaptation responses to those vulnerabilities. The evaluation of vulnerabilities must, at a minimum, be equivalent to the vulnerability assessment contained in the Climate Change Handbook for Regional Water Planning (December, 2011)
> – A process that considers GHG emissions when choosing between project alternatives.
> – The IRWM Plan must include a list of prioritized vulnerabilities based on the vulnerability assessment and the IRWM's decision making process.
> – The IRWM Plan must contain a plan, program, or methodology for further data gathering and analysis of the prioritized vulnerabilities.

When assessing and evaluating climate change impacts and vulnerabilities, DWR's guidelines encourage IRWMP regions to bear in mind four documents in particular. These documents are briefly described below:

1. **Climate Change Handbook for Regional Water Planning**. The Climate Change Handbook for Regional Water Planning (Handbook) assists IRWMP regions in incorporating climate change analysis and methodologies into their planning efforts (DWR USEPA USACE 2011). As noted above, Proposition 84 guidelines require that the climate change evaluation in this plan be equivalent to the vulnerability assessment contained in the Climate Change Handbook for Regional Water Planning. The climate change work completed for this chapter follows the suggested guidelines laid out in the Handbook.
2. **Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water.** This white paper published by DWR urges a new approach to managing California's water and other natural resources in the face of climate change (DWR 2008). The document emphasizes IRWM as the mechanism for fostering a collaborative regional approach to water management. The recommendations from the white paper are incorporated into Volume 1 Chapter 7 of California Water Plan.
3. **Safeguarding California**. The CNRA's Safeguarding California (CNRA 2014) updated the California Climate Adaptation Strategy (2009) and discusses statewide and sector-specific vulnerability assessments, looking in particular at which climate factors will be driving impacts in each sector and how impacts interact across sectors. By identifying these inter-relationships, the document highlights opportunities to implement adaptation strategies across sectors. The report also provides comprehensive lists of adaptation by sector.
4. **Climate Change Scoping Plan**. CARB's Climate Change Scoping Plan (CARB 2008, 2014) describes different statewide greenhouse gas (GHG) emissions sectors, including water management, and recommends specific strategies that may help reduce GHG emissions. The 2014 update provides strategies for important GHG emissions sectors in the UFR Region, including agriculture, water, and natural and working lands.

8.1.2 Chapter Resources

This chapter is supported by numerous resources ranging from scholarly journals to local insights. The published resources used to support the analysis in this chapter are listed in (Section 8.7). It is important to note that the UFR watershed is incredibly diverse and has different climate and hydrological conditions throughout. The watershed is also remote and has limited data availability for some of the basins and sub basins. Due to its importance to state water and energy resources, the majority of available reliable data focuses on the North Fork of the Upper Feather River.

In addition to published resources, the planning team obtained local expertise through questionnaires administered via e-mail and in person to the UFR Regional Water Management Group (RWMG); phone interviews with staff from the counties located in the planning area; a climate change workshop in Quincy, CA in August 2015; and a presentation of this chapter to the RWMG in October 2015. The written and human resources used to develop this chapter ensure the proper balance of rigorous research and on-the-ground local knowledge.

8.2 Climate Change Trends

8.2.1 Introduction

Observed warming of the global climate system is unequivocal. Since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased; these observed global changes are expected to continue and accelerate into the foreseeable future (Stocker et. al 2013). Scientists use models to project future climate conditions. Although models are imperfect and include assumptions and uncertainty, they provide the best available estimate of future conditions.

The local effects of global climate warming vary greatly depending on location. The state of California provides the Cal-Adapt data portal, a website that offers the best available local climate projections for a variety of variables under different climate change scenarios. The data used in the Cal-Adapt tools has been gathered from California's scientific community and represents the most current data available. The planning team used Cal-Adapt's Community Climate System Model 3.0 (CCSM3) to gather climate projections in the planning area for temperature and precipitation under a high and low emissions scenario.

The CCSM3 model is a coupled climate model for simulating the earth's climate system and is composed of one central coupler component and four separate models that simultaneously simulate the earth's atmosphere, ocean, land surface, and sea ice. The CCSM3 model is the default model when selecting data from Cal-Adapt.

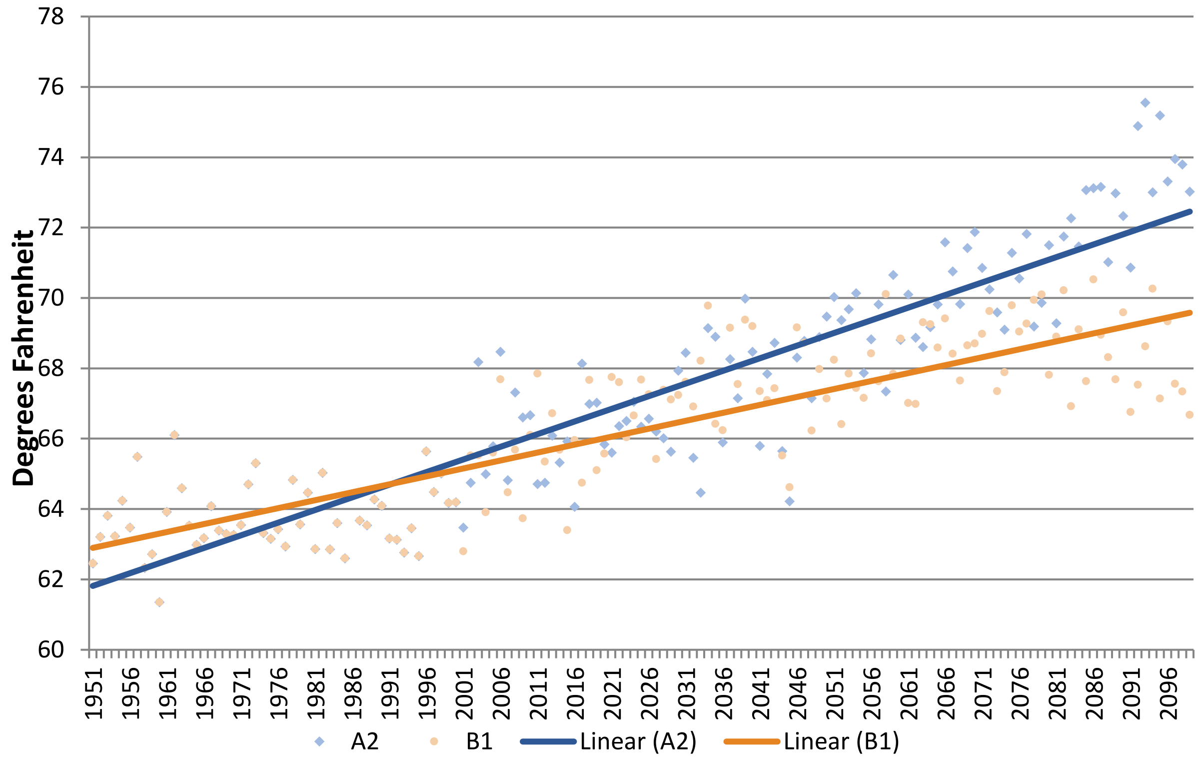
Among the primary drivers of climate projections are GHG emissions scenarios. The Intergovernmental Panel on Climate Change (IPCC) has developed a set of possible future GHG emissions based on different scenarios of global population growth, economic growth, and government regulations of GHGs. Cal-Adapt projections are available for two IPCC emissions scenarios, A2 or B1:

- A2 is the medium-high emissions scenario. The A2 emissions scenario assumes continuous population growth and uneven economic and technological growth. It also assumes that heat-trapping emissions increase through the 21st century and that atmospheric carbon dioxide (CO_2) concentration approximately triples, relative to preindustrial levels, by 2100.
- B1 is the lower emissions scenario. The B1 emissions scenario assumes a world with high economic growth and a global population that peaks by mid-century and then declines. Under this scenario, there is a rapid shift toward less fossil fuel-intensive industries and the introduction of clean and resource-efficient technologies. Heat-trapping emissions peak about mid-century and then decline; CO_2 concentration approximately doubles, relative to preindustrial levels, by 2100.

The planning team reviewed temperature and precipitation projections in the planning area through the 21st century. The figures below show the outputs for mean annual high temperature (Figure 8-1) and average annual precipitation per decade (Figure 8-2). For both emissions scenarios, temperature is expected to increase over the next century. Under the more extreme A2 scenario, the models show that temperatures would be expected to increase on average by approximately 5°F between 2000 and 2100. These averages smooth out temperature anomalies such as extreme heat and heat waves, which are also expected to increase as a result of climate change. Additionally, minimum temperatures are expected to increase through 2100, which could impact snowpack levels.

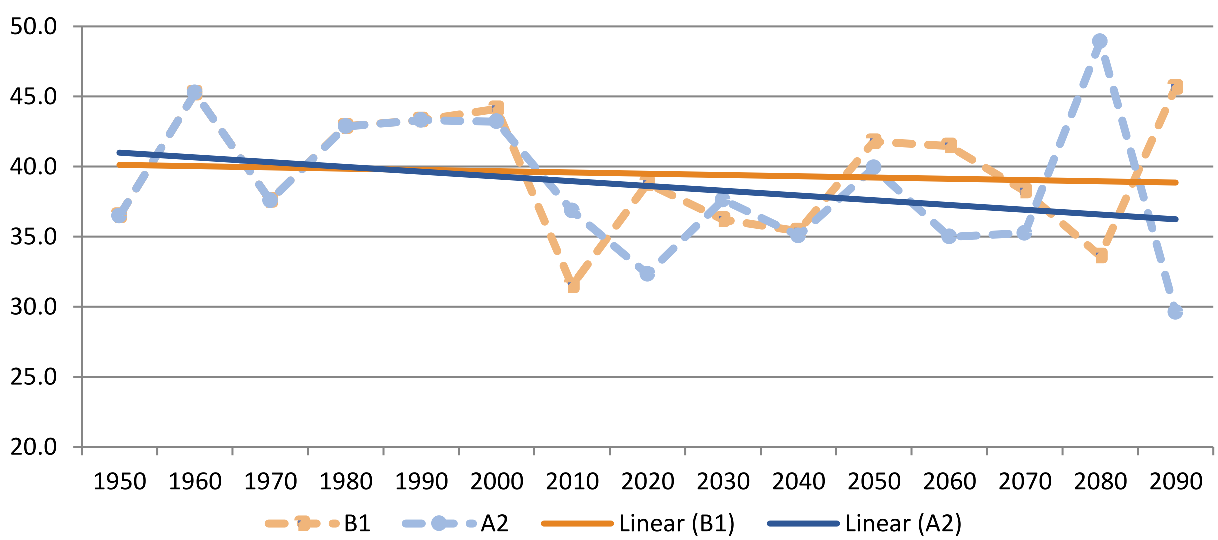
The trend is less clear with the model outputs for precipitation. The A2 scenario shows a slightly larger decrease in annual precipitation across the region; however, the decrease is not substantial under either scenario. What is shown is increasing variability in the amount of precipitation over time. The RWMG should continue to monitor precipitation projections as they become more refined and accurate. In the meantime, the planning area should expect the recent phenomenon of prolonged drought occasionally interspersed by intense downpour events to continue.

Figure 8-1. Mean Annual High Temperature (Fahrenheit)



Source: Cal-Adapt 2015

Figure 8-2. Annual Average Inches of Precipitation per Decade (A2 and B1)



Source: Cal-Adapt 2015

The changes in temperature and variability in precipitation are consistent with changes expected throughout the state. As a result of these changes, the state of California expects numerous climate change impacts to occur and worsen through the next century, including increased wildfires, decreased snowpack and snowmelt runoff, increasingly severe droughts, shifting habitat and threats to biodiversity, damage to forest health, and impacts on energy demand and energy production (CNRA 2014). The following discusses specific impacts that are expected to occur as a result of expected climate change including increased wildfire, decreased water supply, changes to water demand, poorer water quality, increased flooding, and changes to ecosystem habitat.

8.2.2 Wildfire

Rising temperatures and longer dry seasons, both of which are expected in the UFR watershed as a result of climate change, increase the risk of wildfire (DWR 2015c). Rising temperatures and earlier snowmelt are shown to increase the frequency, size, and severity of wildfires, trends which align with wildfire activity in the Sierra Nevada since the early 1980s (USDA 2013a). According to the Cal-Adapt Wildfire: Fire Risk Map (2015), the UFR watershed may experience a one- to twofold increase in burned area by 2050 and a two- to threefold increase in burned area by 2085.

In addition to the increased risk of wildfires from higher temperatures and ongoing drought, increasing fuel supply exacerbates the issue. As carbon dioxide supply increases with ongoing emissions and winter snows are replaced by heavy rain, the growth of plants is expected to accelerate (ibid). Grasslands and brush species are positioned to flourish in this scenario, as they require less water and can rebound quickly from wildfires. The Region's existing coniferous forests will be increasingly vulnerable due to slower growth, difficulty of migration, and increased dryness.

While severity of wildfire is typically inversely related to frequency, research in the Sierra Nevada region indicates that fuel growth described above (more fuel-rich and drier) will likely increase both the frequency and the severity of fires. This will reduce the ability of large trees, such as conifers, to continue to migrate upslope and rebound from past events, as grassland will be quicker to rebound and provide adequate fuel for the next fire (USDA 2013b).

These projected patterns for wildfires pose a serious threat to water quality in the UFR. Decreased forest and vegetation area as a result of catastrophic wildfire reduces the stability of soils, increasing erosion rates and runoff. If a heavy rain event occurs after a fire, soil, ash, and sediment flow into surface water resources in the UFR watershed, degrading water quality (SNC 2014). Climate projections estimate that when precipitation does occur, it will be in the form of heavy rains, increasing the volume of water to carry sediment over burned areas into streams and waterbodies (DWR 2015c).

8.2.3 Water Supply

The most significant water supply concern in the UFR associated with climate change is the reduction in precipitation, winter snowpack accumulation, and aquifer outflow from springs. Precipitation, occurring as both rain and snow, supply water for the residents of the region as well as runoff to Lake Oroville, a key feature of the State Water Project.

Climate change can directly affect the volume, timing, and type of precipitation (rain or snow) which affects the hydrologic cycle in the UFR basin and impacts the availability of water for beneficial use. The climate within the watershed is Mediterranean, with most of the annual precipitation occurring during the winter (November through March). Because the basin includes large areas that are near the average snowline, rainfall and rain-snow mixtures are common during winter storms. Consequently, the overall timing and rates of runoff from the basin are highly sensitive to winter temperature fluctuations (USGS 2005). This increases the potential for climate change effects associated with a reduced low elevation snowpack and a decrease in the annual watershed runoff.

As described in the vulnerability assessment, below, the interactions between climate, weather, and geology related to water resources in the UFR watershed are complex. A historical declining trend of unimpaired runoff was found for the North, Middle, and South Forks of the Feather River. Potential climate change impacts appear to be pronounced on the North Fork where permeable volcanic bedrock composition tends to contribute larger fractions of groundwater flow to streams than other parts of the Feather River basin.

Runoff from the North Fork is affected by annual reductions in rainfall and snowpack accumulation and melt, and the prolonged dry period which has significantly reduced flow from springs that provide baseline flows. The UFR watershed is experiencing some of the largest impacts in California from the decline of low elevation snowfall and early snowmelt (Freeman 2010). These observed impacts are expected to be exacerbated by future climate change. Models predict that by the end of the century, the Sierra snowpack may experience a 48–65 percent loss from the 1961–1990 average (DWR 2015c). Less snow predicted in the UFR watershed due to climate change coinciding with natural dry cycles (as evidenced from recent volcanic aquifer decline) will cause the resultant runoff impact to be more significant than otherwise anticipated (Freeman 2015).

Increased evapotranspiration in the UFR watershed is likely taking place in the mixed conifer forests due to rising air temperatures. Increased forest growth and higher temperatures are the two key factors contributing to the increased evapotranspiration that has taken place in recent years. Forest management adaptations to precipitation variability, higher temperatures, and more extreme weather events are paramount to how the UFR, surrounding regions, and much of Northern California adapts to climate change with respect to water supply and ecological needs. Because the UFR is the source water area for Lake Oroville, which provides water supply to the State Water Project, understanding how specific management strategies affect the forests' responses to climate change will continue to grow in importance.

8.2.4 Water Demand

As water supply becomes increasingly tenuous, even steady levels of demand can put stress on the watershed. As surface water resources are diminished by decreased snowmelt, water users who previously depended on water from streams may turn to groundwater resources, extracting water at a faster rate than can be recharged. While currently groundwater makes up only a small amount of the watershed's overall water supply, it is the major supply source for rural single-family homes as well as public and private water supply systems. In rural areas, many homes are not connected to a municipal water system and are entirely dependent upon private wells for domestic use. As both groundwater and surface water resources diminish during drought period, these wells can be impacted by sedimentation, contaminants, or decreases in aquifer levels. Portions of the Sierra Valley, the largest groundwater aquifer in the watershed, have experienced declining water levels in recent decades (DWR 2013e). The population of the Sacramento River Basin, which includes the UFR watershed, is expected to double in the next 50 years, placing more demand from urban uses on the diminishing water supply although effects are expected to be less significant in the UFR Region of the Sacramento River Basin (Sac RWP 2010).

8.2.5 Water Quality

Water quality in the UFR is generally considered to be good. The primary threats to water quality in the UFR are from impacts related to common land and water use practices in this watershed, (e.g., ranching, mining, timber harvest, road construction/maintenance, and rural residential development (ibid.).

While it is unclear how average precipitation will specifically change with climate change, it is generally agreed that storm severity will probably increase. More intense, severe storms may lead to increased erosion, thus increasing turbidity in surface waters. Warming temperatures will result in lower dissolved oxygen levels in waterbodies, which are exacerbated by potential algal blooms and in turn enhanced eutrophication. Climate-induced increases in storm intensity may alter pollutant concentrations in waterbodies and produce increased turbidity. This could, in turn, decrease water quality. Stakeholders noted that issues related to eutrophication, such as low dissolved oxygen or algal blooms, are limited to reservoirs and that reservoir water temperature is relatively elevated under existing conditions, with increasing potential risks from temperature increases anticipated with climate change.

The increased risk of catastrophic wildfire associated with higher temperatures, and prolonged periods of drought, followed by significant storm events, may result in runoff and sedimentation that pose a significant threat to water quality in portions of the UFR such as the Feather River Canyon.

8.2.6 Flooding

Flooding poses numerous risks to critical facilities and infrastructure including roads or railroads blocked or damaged during flood events, bridges washed out or blocked, backed-up drainage systems, drinking water contamination, sewer systems backed up, and damage to underground utilities (Plumas Co. 2013d). In the UFR, flooding is of greatest concern during rain-on-snow events that increase the probability of high runoff. Increasing temperatures and reduced and earlier snowmelt are shown to increase the frequency of wildfires. Avalanche chutes, debris chutes, and alluvial fans can be extremely active in flood events that occur after wildfires, which can degrade the quality of the habitat and threaten aquatic species. Unmitigated forest growth without the intervention of a fuels reduction program increases the risk of catastrophic fire which may intensify flooding impacts.

8.2.7 Ecosystem Habitat

Impacts of climate change such as rising temperatures and changing precipitation patterns can have a lasting impact on the unique habitats and native species found in the UFR watershed (DWR 2015c). In the mountainous parts of the watershed, temperature increases have led to thermal stress for species acclimated to a cooler climate. Forced upslope migrations and upward latitude changes have been observed in recent years, a trend that is expected to continue with increased climate-change related warming (USDA 2013a). These forced migrations can cause thermal or other stress on native species, increasing the vulnerability of the watershed's habitats. Species that are found only in the UFR watershed are especially vulnerable to temperature increases or changes in water availability, as upward migration may not be physically possible in the time needed. Diversions and dams throughout the watershed fragment the habitat and inhibit the ability of thermally stressed inhabitants to access higher altitude and latitude environs more suitable to their biological requirements.

These changes can also have a dramatic effect on the balance of species in the watershed. As some native species struggle to adapt or move as a result of warming temperatures, "habitat generalists" including invasive plants, insects, and pathogens may find it easier to survive and further reduce habitat availability for natives. Heat-tolerant species will be especially positioned to take habitat from native species (Hoshovsky 2013). Warming and snowmelt earlier in the year may not only impact the habitats of species native to the watershed, but could also mismatch timing or distribution among species. For example, disruptions to normal hatching patterns may shift so that insect-eating species may be present before or after the hatching of their insect prey. This unbalanced distribution of species presence and patterns can further endanger species that depend on annual cycles for food, and allow the uncheck growth of another population (ibid.).

The increasing risk of wildfire, as discussed above, also has the potential to disrupt habitats. As frequency and intensity of fires increases, habitats and plant and animal populations will have less time to recover, increasing vulnerability (ibid). Shifting precipitation patterns toward more winter rain is expected to increase grass biomass in the watershed, which serves an increased fuel for fires. After wildfires are extinguished, invasive vegetation, grasslands and brush species will be far faster to recover than trees, fostering a burn and regrowth cycle that reduces and eventually eliminates habitat availability for tree species. This can decrease both the number of old-growth forest trees and threaten old-growth dependent flora and fauna (USDA 2013b).

8.3 Regional Climate Change Vulnerabilities

Assets in the UFR watershed have varying capacity to respond to different climate change impacts. This section examines major climate change vulnerabilities related to water resources in the UFR watershed. This section presents the *Climate Change Handbook for Regional Water Planning* Vulnerability Assessment Checklist, per Proposition 84 guidelines. The checklist is presented by categories and provides key questions to assess vulnerability in each category. The responses to each question include cross-references to resource management strategies that could be employed to enhance regional adaptation to climate change impacts. As noted earlier in this chapter, the answers to each question below were derived using published resources, via questionnaires filled out by members of the RWMG and each of the working groups, and in a three-hour in-person working session with RWMG and working group members. The section concludes with a summary and prioritization of climate change vulnerabilities.

8.3.1 Water Demand

1) Are there major industries that require cooling/process water in your planning region?

☒Yes ☐ No ☐ Perhaps/Uncertain

Agriculture, forestry, wood products, agricultural crops, energy production, and tourism are the main economic activities in the planning region. Some of these activities in the UFR Region require cooling water. Collins Pine Company operates a wood products manufacturing and co-generation electricity generating facility in Chester. Sierra Pacific Industries, in Quincy, also uses a cooling tower for a co-generation plant. These facilities are critical for handling biomass during wildfire prevention and response activities. Additionally, some timber mills in the Region require cooling water for log decks to avoid wood drying and staining.

2) Does water use vary by more than 50 percent seasonally in parts of your region?

☒ Yes ☐ No ☐ Perhaps/Uncertain

The largest change in variability as a result of climate change is a longer forest growing season and higher rates of evapotranspiration. Crop irrigation for hay and small fruit and nut operations, which have high seasonal variability, is also a substantial source of water demand in the UFR Region, with some suggesting it exceeds 50 percent of total anthropogenic water use. Additionally, the regional population grows significantly in the summer, with an influx of seasonal residents and tourists. These factors create seasonal water use patterns that depend on increased water availability in the summer months. Drought, earlier snowmelt, and decreased flows are expected to continue and worsen in the future, making this high demand period increasingly vulnerable to water shortages.

3) Are crops grown in your region climate-sensitive? Would shifts in daily heat patterns, such as how long heat lingers before night-time cooling, be prohibitive for some crops?

☒ Yes ☐ No ☐ Perhaps/Uncertain

Timber production is an important regional commodity. While the UFR watershed's coniferous forests are more resilient to temperature fluctuations than many crops, decreases in precipitation may weaken the productive capacity of this sector. Climate impacts would be prohibitive for a small number of other crops in the region. A majority of the field crops in the region are hay (alfalfa, meadow, and grain) and pasture (irrigated, nonirrigated, and range). In 2011, these crops were valued at $9,591,000 in Plumas County and $3,200,363 in Sierra County. Miscellaneous crops (nursery, apiary, seed, fruit, potatoes, and grains) accounted for $250,000 of agricultural output in Plumas County and $35,000 in Sierra County (Plumas Co. 2011). While these crop types represent a very small portion of the region's economy and land use, fruit and nut crops are some of the most sensitive to climate change impacts, specifically changes in precipitation and temperature (CDFA 2013). Warming has been greatest in the Sierra Nevada foothill and mountain region, where the UFR watershed is located, increasing the vulnerability of temperature impacts to agricultural operations (ibid.).

4) Do groundwater supplies in your region lack resiliency after drought events?

☒ Yes ☐ No ☐ Perhaps/Uncertain

Much of the region's drinking water comes from groundwater supplies. Drought conditions prevent aquifers from recharging, a problem that is exacerbated when groundwater withdrawal exceeds infiltration. In the Upper North Fork Feather River, aquifer outflow has decreased 36 percent, a possible result of an earlier spring snowmelt period (Freeman 2012). In sustained drought conditions, any existing use of surface waters may be curtailed, shifting even more consumption to groundwater basins. This potentially increases vulnerability to subsidence, groundwater depletion, and decreased water supply for other essential water uses. The Sierra Valley Aquifer, the largest in the UFR watershed, has demonstrated a downward trend in water levels from 2005. All wells monitored by the Sierra Valley Groundwater Management District (SVGMD) had lower water levels in 2015 than they did in 2005, with some water levels nearly 20 feet deeper (SVGMD 2015). Previously, increases in groundwater pumping for irrigation and extreme drought conditions in the late 1970s led to a steady decline in Sierra Valley Aquifer water levels. Levels were slowly restored, reaching earlier 1970 levels by the late 1990s (DWR 2004c). This suggests a slow recharge pattern in a decade-long drier precipitation pattern that may require additional management to conserve aquifer resiliency with continued growth in water demands and prolonged drought conditions.

The region is geographically and hydrologically diverse. Because of this, drought events impact the regions of the watershed differently. For example, a 2006 study for the Lake Front at Walker Ranch development, located on the west shore of the Lake Almanor Peninsula on the northeast side of the lake, determined that the Lake Almanor Groundwater Basin and the Mountain Meadows Valley Groundwater Basin were not in risk of overdraft. These basins are identified to have high capacity for recharge, increasing their resiliency to drought (Kleinfelder 2007). Groundwater monitoring data to sufficiently measure drought resiliency is not available for all basins and sub basins.

5) Are water use curtailment measures effective in your region?

☐ Yes ☐ No ☒ Perhaps/Uncertain

Plumas County proclaimed a local drought emergency on August 19, 2014 (Plumas Co. 2014). These exemptions provide necessary relief to water users who depend on dwindling resources, but continued reliance may increase vulnerability. A sustained drought may increase hardships on the over 1,000 riparian and appropriative water rights holders in the region (ESF 2005, p. 4-3). The State Water Resources Control Board (SWRCB) has extended mandatory curtailments on all water rights, including senior water rights holders. These curtailments vary in severity across the watershed but have especially impacted post-1914 water rights holders in the region. As of June 2015, the region had reduced metered residential water use by 22 percent, achieving SWRCB targets. In this regard, curtailment measures have effectively met state requirements. However, these curtailments have been challenging, especially for small and isolated communities in the UFR Region without access to other water sources. Although curtailment measures have met SWRCB requirements, if drought conditions persist or worsen, it is unclear how additional curtailments can be achieved in economically distressed communities with rapidly diminishing water supplies and no access to alternative water supplies.

6) Are some instream flow requirements in your region either currently insufficient to support aquatic life, or occasionally unmet?

☒ Yes ☐ No ☐ Perhaps/Uncertain

The UFR has a breadth of users and cannot always support the flows needed by each sector especially during the summer and fall "low flow" seasons. Hydropower, timber manufacturing, agriculture, and tourism all make separate demands on the watershed. Aquatic species in the UFR that are already vulnerable to periods of low flow may become increasingly susceptible to harm as snowmelt patterns change. Although environmental water law in California reserves surface water resources for aquatic species, diminished flow magnitude from reduced runoff and sustained withdrawal from agricultural and urban users can significantly reduce biological integrity of aquatic communities (USDA 2013a). Because river flow plays such an integral part in aquatic ecosystems, even moderate changes in magnitude can disrupt fish and macroinvertebrates (Carlisle et al. 2010). In the last half-century, high-flow periods have occurred earlier as a consequence of warmer spring temperatures and the resulting snowmelt. This spring peak runoff creates a lower flow period in the summer. These shifting flows create extended, extreme wet and dry periods, which are difficult to manage and can disrupt the delivery of necessary flows for economic, recreational, and environmental needs (USDA 2013a). The current drought has significantly reduced flows across the UFR watershed, especially in the North Fork, damaging Coldwater fish populations as a result.

Resource Management Strategies (RMS) for adapting to water demand vulnerabilities:

- Agricultural water use efficiency
- Urban water use efficiency
- Conveyance – regional/local
- System reoperation
- Water transfers
- Conjunctive management
- Precipitation enhancement
- Drinking water treatment and distribution
- Matching water quality to water use
- Agricultural land stewardship
- Land use planning and management
- Economic incentives
- Outreach and engagement
- Water and culture

8.3.2 Water Supply

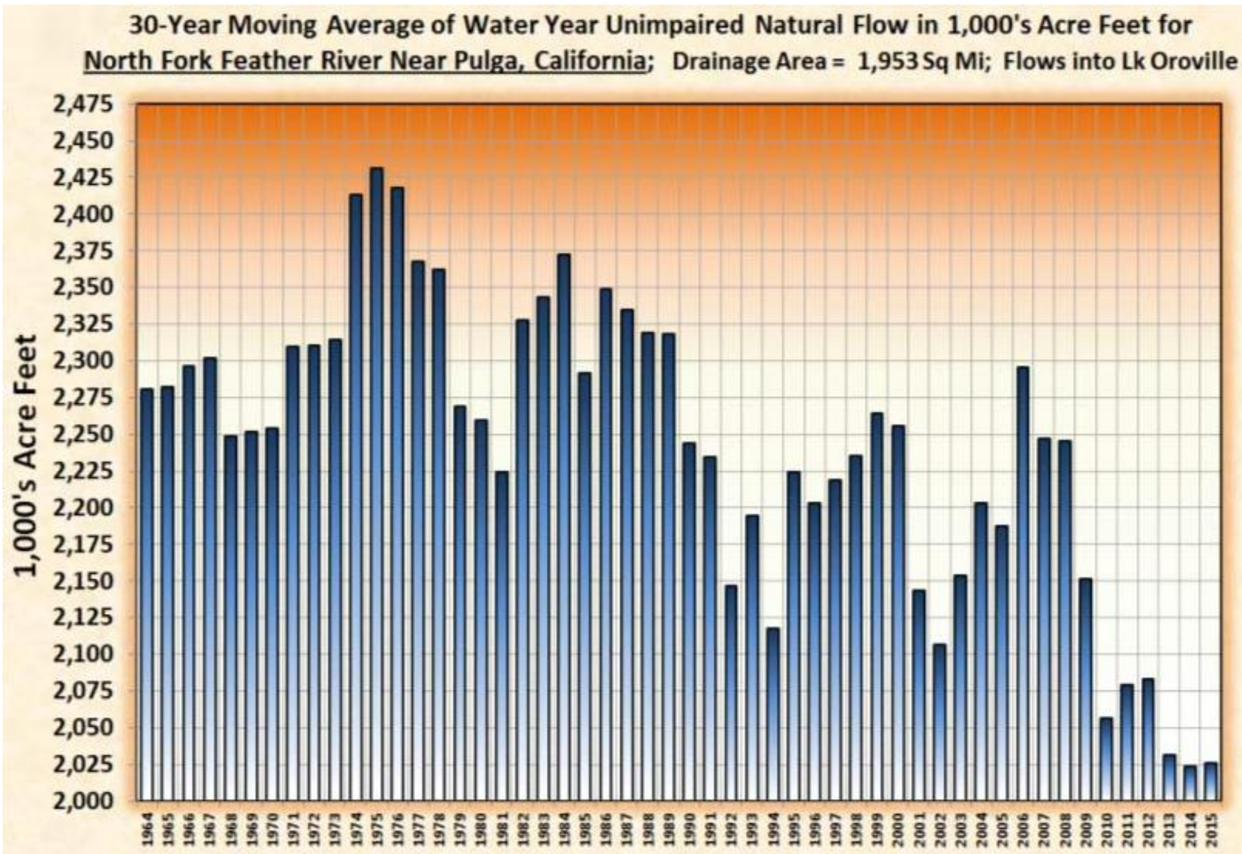
1) Does a portion of the water supply in your region come from snowmelt?

☒ Yes ☐ No ☐ Perhaps/Uncertain

According to the California Water Plan Regional Report for the Mountain Counties Area, the majority of water originates as surface water flows from the Sierra Nevada (DWR 2013e). The Upper Feather River watershed receives water runoff from snowmelt, with the amount of snowfall largely dependent on the location and topography within the UFR watershed (Freeman 2012). In Plumas County, snowpack at high elevations serves as a natural water reservoir that drains into the water system throughout the year (Plumas Co. 2012d). Plumas County includes approximately 72 percent of the UFR watershed. A study showed that sub-basins within the UFR watershed that are either in a rain shadow or behind topographic barriers are more likely to be impacted by climate change due to reduced snowpack and spring runoff (Freeman 2010), resulting in reduced runoff for the water year. Highly impacted sub basins within the UFR watershed include the Lake Almanor sub basin and the East Branch North Fork Feather River sub basin. An analysis of the unimpaired natural flow of the Middle Fork and the South Fork of the Feather River (similar to the analysis shown in Figure 8-3) indicates that flows in the Middle Fork and South Fork have been impacted to a lesser degree than the North Fork. Additionally, the UFR watershed is experiencing some of the largest impacts in California from the decline of low elevation snowfall and early snowmelt (Freeman 2010). Less snow predicted in the UFR watershed due to climate change coinciding with natural dry cycles (as evidenced from recent volcanic aquifer decline) will cause the resultant runoff impact to be more significant than otherwise anticipated (Freeman 2015).

Figure 8- 3 illustrates the 30-year moving average (ex. data point 1964 is the average of 1935 through 1964) of the Water Year (October 1 through September 30) unimpaired natural flow for the North Fork Feather River near Pulga for the period 1964 through 2015. The declining trend indicates that over this period, 1935 through 2015, the North Fork Feather River has experienced a reduction in annual runoff restricting the ability to meet water demands.

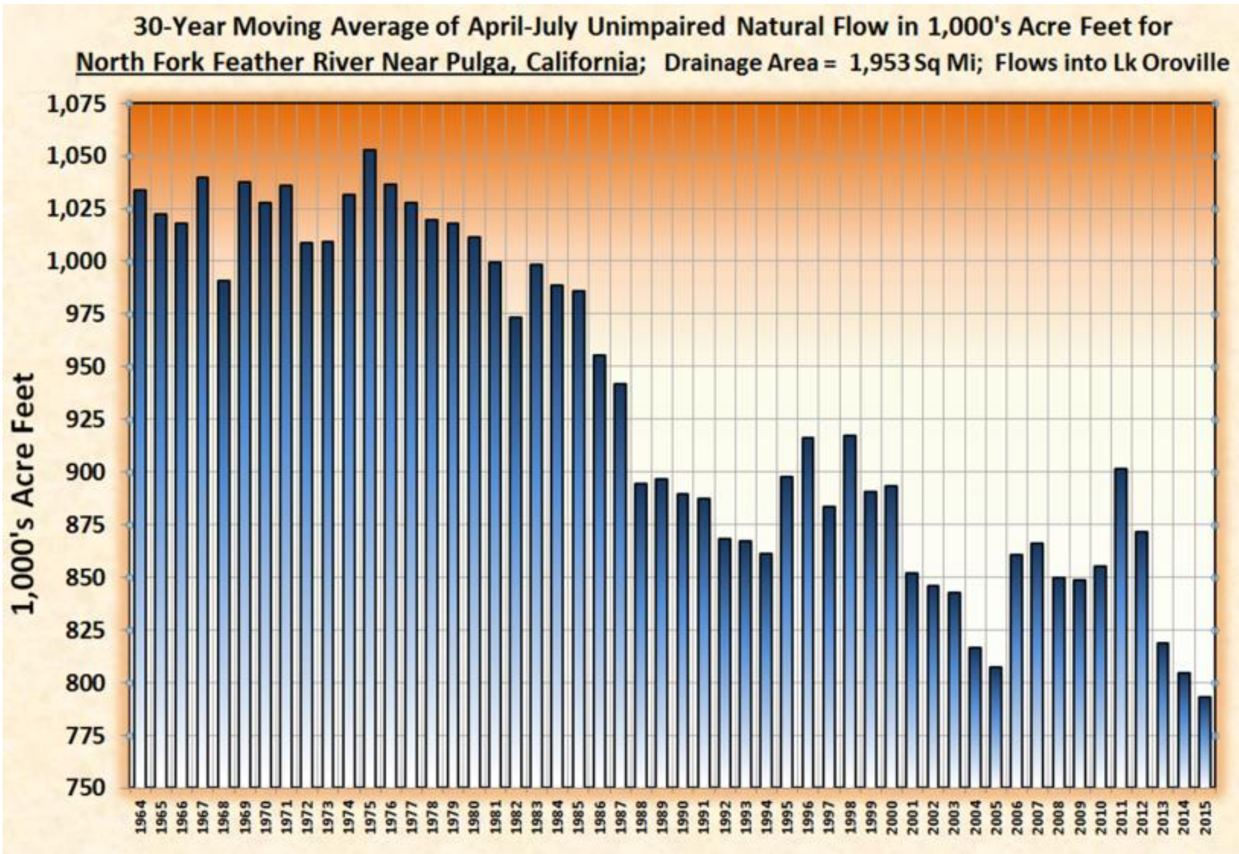
Figure 8-3. North Fork Feather River Water Year (October 1–September 30) Runoff



Source: Freeman 2015.

Figure 8-4 illustrates the 30-year moving average of April through July unimpaired natural flow for the North Fork Feather River near Pulga. Although similar to the Water Year chart above, we see an even starker declining trend indicating not only a reduction in overall flow, but also a reduction of that flow occurring as snowmelt which typically makes up the bulk of the flow occurring during the April through July period.

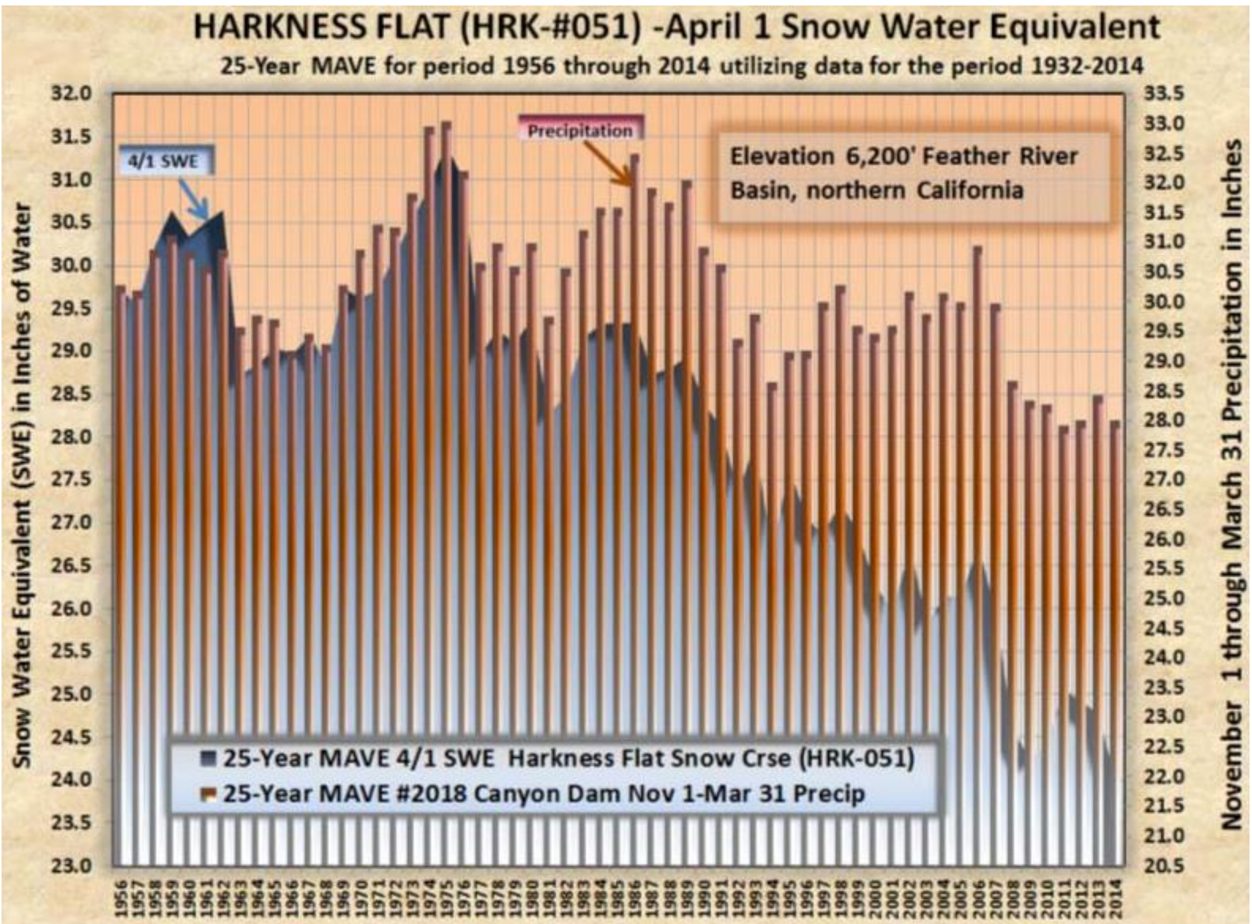
Figure 8-4. North Fork Feather River April–July Runoff



Source: Freeman 2015.

Figure 8-5 illustrates the 25-year moving average of the April 1 Harkness Flat Snow Course located on the Upper North Fork Feather River utilizing the period 1932 through 2014. This snow course is a permanent site that represents snowpack conditions in snow water equivalent. Snow water equivalent is the depth, in inches, of the water that would form if the snow were to melt. There is a declining trend suggesting a reduced snowpack over time. This matches the conclusion discussed above of a reduced snowpack over time. The figure also charts the 25-year moving average of the November 1 through March 31 precipitation at Canyon Dam (Lake Almanor). This, too, indicates a trend of reduced precipitation over time.

Figure 8-5. Harkness Flat Snow Course April 1 Snow Water Equivalent and November 1 through March 31 Precipitation at Canyon Dam



Source: Freeman 2015.

2) Does part of your region rely on water diverted from the Delta, imported from the Colorado River, or imported from other climate-sensitive systems outside your region?

☒ Yes ☐ No ☐ Perhaps/Uncertain

Water is diverted by canal from Little Truckee River, a primary tributary to the Truckee River, into Webber Creek for supplemental irrigation use in portions of the Sierra Valley. These waters eventually flow into the Feather River Basin. The maximum diversion rate is 60 cubic feet per second during the growing season

(March 15 through September 30). This interbasin water diversion varies from about 1,500 acre-feet per year to 10,000 acre-feet per year with an average of about 5,700 acre-feet per year (State of Nevada 1997).

3) Does part of your region rely on coastal aquifers? Has salt intrusion been a problem in the past?

☐ Yes ☒ No ☐ Perhaps/Uncertain

The region is not located near the coast. Salt intrusion is not an issue for the region.

4) Would your region have difficulty in storing carryover supply surpluses from year to year?

☒ Yes ☐ No ☐ Perhaps/Uncertain

Reservoirs in the UFR historically spill frequently during the spring when inflow exceeds both the available usable capacity of the seasonal reservoirs and the capacity of releasing inflow through outlets (Freeman 2012). Rain-shadowed sub basins in the watershed are experiencing earlier snowmelt, an increased proportion of precipitation occurring as rain with less snowfall overall, and reduced aquifer outflow from springs. The filling of mountain reservoirs from snowmelt earlier in the year and an increasing dependence on rainfall for filling is anticipated to eventually lead to an increased likelihood for spill from reservoirs in the UFR watershed (ibid.). Under these conditions, reservoirs without mandated flood reservations are expected to be operated to hold storage higher than historical practice to help meet late summer and fall water demands, which will increase the risk of reservoir spills. As snowpack reduces, there is likely to be increased motivation to hold water in storage. According to stakeholders, meadows in the basin have been impacted reducing their capacity to store water and relax the natural flow hydrograph. Stakeholders also noted that there is unused groundwater storage, primarily in the North Fork Feather River basin, and that stormwater capture could be a source of water.

5) Has your region faced a drought in the past during which it failed to meet local water demands?

☒ Yes ☐ No ☐ Perhaps/Uncertain

According to the Plumas County General Plan, adequate water supply is currently available for water purveyors in Plumas County and all have reported sufficient supply to meet projected water demands until 2030 (Plumas Co. 2012e). The majority of potable water supply in Plumas County is provided by a variety of individual Community Service Areas (CSA), Community Services Districts (CSDs), and Public Utility Districts (PUDs) that serve the various communities located throughout the region. During water years 2014 and 2015, due to statewide drought conditions, the State Water Resources Control Board (SWRCB) curtailed post-1914 water rights tributary to the Sacramento-San Joaquin Delta, including the UFR watershed. This curtailment reduced the ability to divert water, impacting water supply availability. In response, water purveyor demand management plans have been effective in balancing available water supply with demand. Climate change impacts could lead to more severe, frequent, and prolonged drought conditions, reducing the reliability of the local water supply. According to stakeholders, during times of drought, some agricultural water supplies are not considered adequate and residential wells have gone dry, requiring drilling deep wells and the trucking of water to homes. Low-income well owners are particularly vulnerable to dry wells or surface water curtailments.

6) Does your region have invasive species management issues at your facilities, along conveyance structures, or in habitat areas?

☒ Yes ☐ No ☐ Perhaps/Uncertain

According to the Environmental Impact Report (EIR) prepared for the Upper North Fork Feather River Hydroelectric Project (UNFFR Project), several invasive and noxious weeds have been introduced to the UFR watershed. Surveys conducted by Garcia and Associates in 2000 found nine species of invasive and noxious weeds occurring in disturbed areas around the reservoirs and along roads and the river within the UNFFR Project area (SWRCB 2014). The EIR also identified a risk of spreading invasive plants or noxious weeds with increased ground disturbance in the areas surrounding the reservoirs, roads, and along the river, which could have an adverse effect on special-status plants that may occur within the UFR watershed (SWRCB 2014).

Certain invasive species are expected to be favored as a result of warming and drying conditions. Additional invasive species act as stressors on native species that, when combined with lower flows or erratic flow regimes more likely with greater climate variability, can cause decreased viability for desired species. Stakeholders noted the existence of yellow star thistle (*Centaurea solstitialis*) in the UFR basin and the concern for introduction of quagga and zebra mussels, which exist in the region, both invasive species that could be advantaged through climate change.

RMS for adapting to water supply vulnerabilities:

- Urban water use efficiency
- Conveyance – regional/local
- System reoperation
- Water transfers
- Conjunctive management
- Precipitation enhancement
- Municipal recycled water
- Surface storage – regional/local
- Drinking water treatment and distribution
- Groundwater remediation/aquifer remediation
- Forest management
- Recharge area protection
- Economic incentives
- Outreach and engagement
- Water-dependent recreation

8.3.3 Water Quality

1) Are increased wildfires a threat in your region? If so, does your region include reservoirs with fire-susceptible vegetation nearby which could pose a water quality concern from increased erosion?

☒ Yes ☐ No ☐ Perhaps/Uncertain

According to a report prepared by the Sierra Nevada Conservancy (2014), *The State of the Sierra Nevada's Forests*, the Sierra Nevada (including the UFR watershed) are at a high risk for uncharacteristically large and damaging wildfires. After fires, burn areas can experience increased erosion rates due to the increases in runoff and lack of vegetation to stabilize the soil. According to the Cal-Adapt Wildfire: Fire Risk Map, the UFR watershed may experience a one- to twofold increase in burned area by 2050 and a two- to threefold increase in burned area by 2085 (Cal-Adapt 2015). The fire season has extended in recent years, according to stakeholders. Increased fire frequency, intensity, and season may 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 has been adversely affected by increased post-fire erosion. According to stakeholders, mercury is a concern as well increasing risks associated with forest densification combined with decades of fire suppression policy and activities. Numerous communities lack adequate water supplies for firefighting, although with the absence of CALFIRE stations in the Region, communities are their own first responders to wildfire for considerable periods of time during large or widespread forest fire events.

2) Does part of your region rely on surface waterbodies with current or recurrent water quality issues related to eutrophication, such as low dissolved oxygen or algal blooms? Are there other water quality constituents potentially exacerbated by climate change?

☒ Yes ☐ No ☐ Perhaps/Uncertain

Water quality in the UFR watershed in Plumas County is generally considered to be good; however, there are general concerns including temperature, dissolved oxygen, sediment, and bacteria. Additionally, several waterbodies are listed on the Clean Water Act's 303(d) list of impaired waters for mercury, copper, temperature, and toxicity. These waters include Feather River, North Fork (below Lake Almanor); and Feather River, South Fork (Little Grass Valley Reservoir to Lake Oroville) (Plumas Co. 2012d).

Water quality in the UFR watershed is heavily influenced by Lake Almanor, as the majority of its water flows through several reservoirs and into Lake Oroville. According to the UNFFR Project EIR, Lake Almanor generally meets water quality objectives set by the SWRCB in the Sacramento Basin Plan. Water temperature in Butt Valley Reservoir is heavily influenced by Lake Almanor and the operation of hydropower facilities. In general, Butt Valley Reservoir, just downstream of Almanor, shows similar dissolved oxygen (DO) concentrations as Lake Almanor, which currently meets water quality objectives. Other reservoirs in the UFR watershed include Belden Forebay, Seneca Reach, and Belden Reach, all of which are directly or indirectly influenced by Lake Almanor and reservoir operations. Thus, water quality is relatively similar to Lake Almanor and Butt Valley Reservoir; however, water temperature fluctuates depending on hydropower operations, and DO can be slightly elevated depending on the time of year (SWRCB 2014).

Warming temperatures will result in lower dissolved oxygen levels in waterbodies, which are exacerbated by potential algal blooms and in turn enhanced eutrophication. Climate-induced increases in storm intensity may alter pollutant concentrations in waterbodies and produce increased turbidity. This could, in turn, decrease water quality.

Stakeholders noted that issues related to eutrophication, such as low dissolved oxygen or algal blooms, are limited to reservoirs and that reservoir water temperature is relatively elevated under existing conditions, increasing potential risk from climate change.

3) Are seasonal low flows decreasing for some waterbodies in your region? If so, are the reduced low flows limiting the waterbodies' assimilative capacity?

☒ Yes ☐ No ☐ Perhaps/Uncertain

UFR watershed flows are largely regulated by a series of hydroelectric projects located on the North Fork Feather River above Oroville Dam. Lake Almanor is the start of the system and was constructed to store water in the winter and spring and release flows throughout the summer and fall for hydropower generation (ibid.).

As stated above under the Water Supply subsection, the rain-shadowed sub basins in the UFR watershed (the Lake Almanor sub basin and the East Branch North Fork Feather River sub basin) are experiencing earlier snowmelt, an increased proportion of precipitation occurring as rainfall with less snowfall overall, and reduced aquifer outflow from springs. This change in precipitation timing and type has resulted in the filling of mountain reservoirs from snowmelt earlier in the year. An increasing dependence on rainfall for filling is anticipated to eventually lead to an increased likelihood for spill from reservoirs (Freeman 2012). It is likely that streamflow will increase in some areas of the UFR watershed during the spring. The Freeman 2012 study considered the possible side effects of climate change on runoff by comparing two consecutive 35-year periods (1942–1976 and 1977–2011). Trend analyses over a moving 30-year average show reductions in flow on tributaries to the Feather River watershed at about 4.5 percent. This would suggest that overall seasonal low flows are decreasing in the UFR watershed. Additionally, these low-flow conditions are expected to be more extreme and last longer. Decreased flows in some waterbodies will likely result in higher concentrations of pollutants and reduced assimilative capacity.

An analysis of the unimpaired natural flow of the Middle Fork and the South Fork of the Feather River (similar to the analysis shown in Figure 8-3) indicates that flows in the Middle Fork and South Fork have been impacted to a lesser degree than the North Fork. The risks to seasonal low flows are also expected to be lesser in the Middle Fork and South Fork.

4) Are there beneficial uses designated for some waterbodies in your region that cannot always be met due to water quality issues?

☒ Yes ☐ No ☐Perhaps/Uncertain

According to the Basin Plan, the North Fork Upper Feather River provides several beneficial uses including municipal and domestic water supply, hydropower generation, water contact recreation, water non-contact recreation, cold freshwater habitat, spawning habitat, and wildlife habitat (Central Valley RWQCB 2011). The Basin Plan indicates the Middle Fork Feather River provides the following beneficial uses: agricultural, recreation, warm and cold water freshwater habitat, spawning habitat, and wild habitat. Beneficial uses for the South Fork Feather River are not listed in the Basin Plan. In addition to hydropower generation, the UNFFR Project provides approximately 30,920 acres of reservoirs and tributaries that provide water contact and water non-contact recreational opportunities (SWRCB 2014). The SWRCB has not reported any water quality issues in connection with beneficial uses.

Overall climate drying and warming could exacerbate elevated water temperatures, a reduced capacity for dilution, potential for eutrophication and total organic carbons related to increased algae presence, sediment and non-point source pollution from more intense storm events and higher peak flows, and the potential for wastewater runoff into receiving waters.

5) Does part of your region currently observe water quality shifts during rain events that impact treatment facility operation?

☒ Yes ☐ No ☐Perhaps/Uncertain

While it is unclear how average precipitation will change with climate change, it is generally agreed that storm severity will probably increase. More intense, severe storms may lead to increased erosion, which will increase turbidity in surface waters. The region’s water treatment needs are met in several ways, including through on-site septic systems, community septic systems, and community wastewater treatment plants (Plumas Co. 2012d, Sierra Co. 2015). At least one system in the watershed has experienced overflows due to excessive inflow, which is exacerbated by rainfall (SWRCB 2009). According to stakeholders, there is a potential risk to water treatment and wastewater treatment facility operation during severe rain events, which could be exacerbated with climate change.

RMS for adapting to water supply vulnerabilities:

- Flood management
- Conveyance – regional/local
- System reoperation
- Precipitation enhancement
- Drinking water treatment and distribution
- Groundwater remediation/aquifer remediation
- Matching water quality to water use
- Pollution prevention
- Salt and salinity management
- Urban stormwater runoff management
- Ecosystem restoration
- Forest management
- Recharge area protection
- Sediment management
- Watershed management

8.3.4 Flooding

1) Does critical infrastructure in your region lie within the 200-year floodplain?

☒ Yes ☐ No ☐ Perhaps/Uncertain

The Federal Emergency Management Agency (FEMA) has developed best available floodplain maps with delineated 100- and 500-year flood zones for Plumas County. The DWR has not delineated the 200-year flood zones in Plumas County. The majority of the 100-year flood zones are associated with local watercourses (Plumas Co. 2012e). Development in the region is discouraged within the 100-year flood zones.

Because the 200-year floodplain is not delineated, it is not known if critical infrastructure lies within the 200-year floodplain. The Plumas County Hazard Mitigation Plan indicates that there are 69 critical facilities (out of 720) at risk from flooding. Critical facilities data were overlaid with flood hazard data to determine the type and number of facilities within the 100- and 500-year floodplain. Flooding poses numerous risks to critical facilities and infrastructure including roads or railroads blocked or damaged, bridges washed out or blocked, backed-up drainage systems, drinking water contamination, sewer systems backed up, and damage to underground utilities (Plumas Co. 2013d).

Localized drainage problems with flooding do occasionally occur. In Plumas County, flooding may result from rainfall and runoff exceeding the capacity of local watercourses, rainfall and runoff to depressions causing localized areas of shallow flooding, or flooding from failure of a dam. Some communities are at risk to flooding from dam failure and inundation (Plumas Co. 2012e). Additionally, and according to stakeholders, the wastewater plant and fire departments are susceptible to flooding that could be increased from climate change.

2) Does part of your region lie within the Sacramento-San Joaquin Drainage District?

☐ Yes ☒ No ☐ Perhaps/Uncertain

The UFR watershed is north of the Sacramento-San Joaquin Drainage District.

3) Does aging critical flood protection infrastructure exist in your region?

☒ Yes ☐ No ☐ Perhaps/Uncertain

Stakeholders indicated that the Taylorsville Mill Race Farmers Dam is in need of repair.

4) Have flood control facilities (such as impoundment structures) been insufficient in the past?

☒ Yes ☐ No ☐ Perhaps/Uncertain

Flood control facilities, including the Big Ditch flood control channel in Chester, have historically provided adequate levels of flood protection. According to stakeholders, local flooding risk is present at road crossing and culverts and the Taylorsville Mill Race Farmers Dam has been insufficient in the past.

5) Are wildfires a concern in parts of your region?

☒ Yes ☐ No ☐ Perhaps/Uncertain

Rising temperatures and earlier snowmelt are shown to increase the frequency of wildfires, especially in Northern California. Fire size and intensity have already increased significantly in the Sierra Nevada since the early 1980s (USDA 2013a). Increasing fuel supply has also led to the regional increase in wildfires, a product of increased winter rains in place of snowfall (ibid.). The Plumas County Hazard Mitigation Plan indicates that the highest fuel hazard is along the Feather River Canyon (Plumas Co. 2013d). The UFR watershed may experience a one- to twofold increase in burned area by 2050 and a two- to threefold increase in burned area by 2085 (Cal-Adapt 2015). This increased risk of severe wildfires poses a significant risk to water quality in the Upper Feather River by increasing sedimentation and runoff that disrupt the river's normal and healthy function. Avalanche chutes, debris chutes, and alluvial fans can be extremely active in flood events that occur after wildfires, which can degrade the quality of the habitat and threaten aquatic species. Unmitigated forest growth without the intervention of a fuels reduction program may increase this risk.

RMS for adapting to flooding vulnerabilities:

- Flood management
- Conveyance – regional/local
- System reoperation
- Precipitation enhancement
- Urban stormwater runoff management
- Land use planning and management
- Watershed management

8.3.5 Ecosystem and Habitat Vulnerability

1) Does your region include inland or coastal aquatic habitats vulnerable to erosion and sedimentation issues?

☒ Yes ☐ No ☐ Perhaps/Uncertain

The region features complex topography and multiple waterways, as well as highly erodible granitic and sedimentary soils. Grazing and timber production in the region's riparian zones have decreased vegetation and increased the amount of sedimentation and runoff in adjacent waterbodies (Plumas Co. FCWCD 2004). In the past, these activities were the leading causes of erosion in the UFR watershed. While these sectors still cause issues of erosion in some portions of the watershed, stakeholders noted that current management practices have significantly decreased their impacts on aquatic habitats. As noted earlier, the growing threat of wildfires will consequently increase the amount of erosion and sedimentation in the watershed, increasing the region's vulnerability to negative habitat impacts as a result. Additionally, roads in the watershed are understood to exacerbate erosion and sedimentation issues.

A variety of aquatic habitats, including lakes, rivers, streams, and reservoirs, exist in the watershed. Aquatic species in the region, including rainbow and brown trout, landlocked Chinook salmon, large- and small-mouth bass, green sunfish, Sacramento perch, channel catfish, and brown bullhead catfish, can be negatively impacted by increased turbidity from sedimentation and erosion (Sierra Institute for Community and Environment 2009).

2) Does your region include estuarine habitats which rely on seasonal freshwater flow patterns?

☐ Yes ☒ No ☐ Perhaps/Uncertain

The region does not encompass any estuarine habitats.

3) Do climate-sensitive fauna or flora populations live in your region?

☒ Yes ☐ No ☐ Perhaps/Uncertain

Although all flora and fauna can be impacted by climate-caused habitat changes, plant and animal species that can live in a broad range of conditions are more resilient to these changes than those that can only survive in a very narrow habitat. Because of an inability to migrate to another habitat, the species that are found only in the Upper Feather River Region are especially sensitive to climate-related changes. The most recent State Wildlife Action Plan identified no fish or invertebrate species as focal species of conservation strategies in the Sierra Nevada Foothills and Sierra Nevada regions, but does identify many amphibian, reptile, and bird species (CDFW 2015). The UFR watershed is diverse and complex, and changes in habitat factors such as temperature or precipitation can impact a wide range of species. In the Sierra Nevada region, 60 percent of coniferous forest bird species are expected to experience significant range reduction, narrowing the amount of acceptable habitat and increasing vulnerability (USDA 2013a). Decreased stream flow and rising water temperatures in the Sierra Nevada are likely to increase thermal stress on salmonids and decrease ranges for sensitive species such as rainbow trout (ibid). Even decreasing winter snowfall can increase grazing by deer and elk throughout the winter, which in turn reduces the growth of certain tree species, damaging essential habitat for songbirds in the region (ibid). The interconnectedness of the region's climate with all of the species that live there means that shifts in normal temperature and precipitation closely impact many of the native species.

4) Do endangered or threatened species exist in your region? Are changes in species distribution already being observed in parts of your region?

☒ Yes ☐ No ☐ Perhaps/Uncertain

Chapter 3 *Region Description* provides an overview of existing endangered and threatened species conditions in the UFR Region. A majority of the existing research on changes in species distribution in the region shows that upslope movement into higher elevations of the Sierra Nevada has been and will continue to be the trend in regional habitat movement (USDA 2013a). A pattern of climate-driven changes in fire activity, which has the potential to further disrupt species distribution, has also already been observed (ibid).

5) Does the region rely on aquatic or water-dependent habitats for recreation or other economic activities?

☒ Yes ☐ No ☐ Perhaps/Uncertain

Fishing, boating, kayaking, swimming, hunting, bird-watching, agritourism, and agriculture are all integral parts of the economic prosperity of the UFR Region. The Plumas County Visitors Bureau promotes outdoor recreation as a popular tourist attraction for the region in every season. Cross-country skiing, longboard racing, snowmobiling, and snowshoeing are winter attractions that may also be negatively impacted by a reduced snowpack (Plumas Co. Visitors Bur. 2015). Agricultural and wood processing industries rely on the watershed for irrigation and milling.

6) Are there rivers in your region with quantified environmental flow requirements or known water quality/quantity stressors to aquatic life?

☒ Yes ☐ No ☐ Perhaps/Uncertain

Pacific Gas and Electric Company (PG&E) manages a number of dams along the North Fork Feather River and releases water to meet minimum flow requirements for aquatic species along the Seneca and Belden reaches. (SWRCB 2014) Diminished flow is an integral predictor of fish and macroinvertebrate community health (USDA 2013a). Stakeholders noted that water has been released from Lake Almanor to reduce issues associated with diminished flows, but high water temperatures and low dissolved oxygen in these releases can be uninhabitable for aquatic species. If sustained drought or increased water temperature continues to exacerbate existing conditions, reduced flow could diminish both the quality and the quantity of habitat for aquatic species (ibid). As mentioned above, flows in the Middle Fork and South Fork have been impacted to a lesser degree than the North Fork.

7) Do estuaries, coastal dunes, wetlands, marshes, or exposed beaches exist in your region? If so, are coastal storms possible/frequent in your region?

☐ Yes ☒ No ☐ Perhaps/Uncertain

There are no estuaries, coastal dunes, wetlands, marshes, or exposed beaches in the region. Coastal storms are not a concern.

8) Does your region include one or more of the habitats described in the Endangered Species Coalition's Top 10 habitats vulnerable to climate change?

☒ Yes ☐ No ☐ Perhaps/Uncertain

Most of the UFR Region in California's Sierra Nevada range, which is identified by the Endangered Species Coalition as one of the top 10 most vulnerable habitats to climate change. The region has a diverse ecosystem, which is dependent on snowmelt from the Sierra Nevada and Cascade ranges to regulate the water cycle and vibrancy of the habitat. Nearly 200 species in the habitat are on California's Special Animals List, which tracks threatened and endangered species in the state. As rains replace winter snows, the annual spring snowmelt will continue to move earlier, disrupting ecosystem function (Endangered Species 2010).

The importance of the watershed is underscored by its listing as an Audubon Important Bird Area. The region supports over 1 percent of the global and 10 percent of the state population of one or more sensitive species, supports more than nine sensitive bird species, hosts 10,000 or more observable shorebirds in one day, and hosts 5,000 or more observable waterfowl in one day. The Important Bird Area surrounding Lake Almanor and Mountain Meadows Reservoir is notable for supporting one of the largest populations of willow flycatchers in the state, which breed in meadows with willow thickets in and around Westwood and Chester (Audubon 2015).

9) Are there areas of fragmented estuarine, aquatic, or wetland wildlife habitat within your region? Are there movement corridors for species to naturally migrate? Are there infrastructure projects planned that might preclude species movement?

☒ Yes ☐ No ☐ Perhaps/Uncertain

The chain of dams in the Upper Feather River Region fragments aquatic habitat and prevents movement of fish and other aquatic wildlife to varying degrees. Additionally, extensive road systems, fencing, and historic mining have damaged the watershed and disrupted natural movement corridors (USDA 2013b). Catastrophic wildfire can also destroy habitat and disrupt natural migration corridors across the UFR watershed.

Integrated planning efforts in the Plumas National Forest have led to significant improvements in forest-wide restoration of habitat connectivity for fish and other aquatic organisms. These aquatic organism passage (AOP) programs, when paired with overall watershed restoration, help to decrease the number of fragmented movement corridors (ibid). At the time of this writing, no known infrastructure projects are planned that might preclude species movement.

RMS for adapting to ecosystem and habitat vulnerabilities:

- Agricultural water use efficiency
- Conveyance – regional/local
- System reoperation
- Conjunctive management
- Pollution prevention
- Salt and salinity management
- Urban stormwater runoff management
- Agricultural land stewardship
- Ecosystem restoration
- Forest management
- Land use planning and management
- Sediment management
- Watershed management
- Water-dependent recreation

8.3.6 Hydropower

1) Is hydropower a source of electricity in your region?

☒ Yes ☐ No ☐ Perhaps/Uncertain

The region's electricity is provided by the Plumas-Sierra Rural Electric Co-op (PSREC) and PG&E. As of 2014, PSREC generated 0.5 percent of its grid-wide energy from small hydroelectric and 33.2 percent from large hydroelectric (Plumas Sierra REC 2014). In 2012, PG&E procured 2 percent of its total electricity from small hydroelectric and 11 percent from large hydroelectric (CA Energy Comm. 2012). This hydropower production may become vulnerable to decreased production capacity if flow volume decreases.

Altogether, the dams on the Upper Feather River produce 9–30 percent of California's power (USDA 2013b).

In the lower North Fork Feather River, PG&E owns a series of reservoirs known as the "stairway of power" for hydropower production (Sac. RWP 2015). Seven dams regulated by the Federal Energy Regulatory Commission (FERC), listed below, are located in the region, five of which are owned and operated by PG&E.

- Bucks Creek (PG&E – Bucks Lake)
- Rock Creek/Cresta (PG&E – North Fork Feather River)
- South Feather (South Feather Water & Power – Little Grass Valley)
- Lake Oroville (California Department of Water Resources)
- Upper North Fork Feather River (PG&E – Almanor/Butt Valley)
- Poe (PG&E – North Fork Feather River)
- Hamilton Branch powerhouse (PG&E – Lake Almanor)

Climate change has the potential to alter the ability of all of the operational hydroelectric facilities in the region to produce power due to shifting temperatures, altered stream flow, and higher rates of evaporation and transpiration in the feeder watersheds (Bryan et al. 2013). While trends in precipitation and temperature can vary significantly across the region, decreases in snowfall and the consequent impacts will be more evenly distributed. Significant declines in snowfall over the past century have been observed in the watershed (USDA 2013a). The watershed depends on Sierra snowmelt for much of its flow. Because of this, the dams along the UFR and its many tributaries are vulnerable to decreased generation as a result of the decreased availability of water resources.

2) Are energy needs in your region expected to increase in the future? If so, are there future plans for hydropower generation facilities or conditions for hydropower generation in your region?

☒ Yes ☐ No ☐ Perhaps/Uncertain

Limited population growth and rising temperatures have the potential to increase demand for energy in the UFR Region. Currently, large-scale hydropower (presented above as the stairway of power) is built-out in the watershed. The region's electricity is primarily provided by the Plumas-Sierra Rural Electric Cooperative, as well as PG&E and the Lassen Municipal Utility District. As of July 2015, FERC has not issued any permits for a new dam. Although some potential exists for smaller hydropower generation facilities, decreases in overall hydropower productivity and increased challenges to building hydropower (such as few undammed rivers, little unallocated water, and growing environmental, economic, and political constraints) may strongly limit facility development (Pacific Institute 2015).

RMS for adapting to hydropower production vulnerabilities:

- Conveyance – regional/local
- Land use planning and management
- Water and culture

8.3.7 *Vulnerability Assessment Summary*

Table 8-1 summarizes the climate change vulnerabilities and relevant resources management associated with each category of water use and resources, as described in the text above.

Table 8-1. Climate Change Vulnerability Summary

Category	Vulnerabilities	Resource Management Strategies
Water Demand	Seasonal variability, climate-sensitive crops, drought-sensitive groundwater supplies, in-stream flow requirements	♦ Agricultural water use efficiency ♦ Urban water use efficiency ♦ Conveyance – regional/local ♦ System reoperation ♦ Water transfers ♦ Conjunctive management ♦ Precipitation enhancement ♦ Drinking water treatment and distribution ♦ Matching water quality to water use ♦ Agricultural land stewardship ♦ Land use planning and management ♦ Economic incentives ♦ Outreach and engagement ♦ Water and culture
Water Supply	Decreased snowfall, worsening of natural dry cycles, decreased water supply	♦ Urban water use efficiency ♦ Conveyance – regional/local ♦ System reoperation ♦ Water transfers ♦ Conjunctive management ♦ Precipitation enhancement ♦ Municipal recycled water ♦ Surface storage – regional/local ♦ Drinking water treatment and distribution ♦ Groundwater remediation/aquifer remediation ♦ Forest management ♦ Recharge area protection ♦ Economic incentives ♦ Outreach and engagement ♦ Water-dependent recreation

Category	Vulnerabilities	Resource Management Strategies
Water Quality	Lower dissolved oxygen levels in waterbodies, potential algal blooms and eutrophication, altered pollutant concentrations in waterbodies, increased turbidity, decreased water quality	♦ Flood management ♦ Conveyance – regional/local ♦ System reoperation ♦ Precipitation enhancement ♦ Drinking water treatment and distribution ♦ Groundwater remediation/aquifer remediation ♦ Matching water quality to water use ♦ Pollution prevention ♦ Salt and salinity management ♦ Urban stormwater runoff management ♦ Ecosystem restoration ♦ Forest management ♦ Recharge area protection ♦ Sediment management ♦ Watershed management
Flooding	Runoff exceeding the capacity of local watercourses, rainfall, and runoff to depressions causing localized areas of shallow flooding, sedimentation resulting from wildfire	♦ Flood management ♦ Conveyance – regional/local ♦ System reoperation ♦ Precipitation enhancement ♦ Urban stormwater runoff management ♦ Land use planning and management ♦ Watershed management
Ecosystem and Habitat Vulnerability	Aquatic habitat erosion and sedimentation, climate-sensitive fauna or flora, endangered or threatened species, aquatic habitats used for economic activities, quantified environmental flow requirements, climate-sensitive habitats, fragmented habitat and movement corridors	♦ Agricultural water use efficiency ♦ Conveyance – regional/local ♦ System reoperation ♦ Conjunctive management ♦ Pollution prevention ♦ Salt and salinity management ♦ Urban stormwater runoff management ♦ Agricultural land stewardship ♦ Ecosystem restoration ♦ Forest management ♦ Land use planning and management ♦ Sediment management ♦ Watershed management ♦ Water-dependent recreation
Hydropower	Hydropower facilities, regional energy needs	♦ Conveyance – regional/local ♦ Land use planning and management ♦ Water and culture ♦ Other strategies

8.4 Prioritizing Vulnerabilities

All of the vulnerabilities listed above represent important issues and considerations for the planning region as a whole. Some vulnerabilities will be of high priority to a certain suite of stakeholders because of their area of expertise, interests, or employment; another stakeholder group's priorities will likely differ for the same reasons. Identifying vulnerabilities for such a diverse group of stakeholders and issues is an exercise in assessing how soon that vulnerability may occur, if it's not already (urgency), and the degree of probability that the vulnerability will become a hazard, if it's not already (risk).

In August 2015, approximately 28 local stakeholders attended a climate change-focused meeting in Quincy, California, and participated in a vulnerability prioritization activity. Table 8-2 displays the results of that activity in terms of urgency and risk, and sorts by priority based on those findings. It is important to make the distinction that these priorities are relative to responding to climate change and not IRWM project prioritization.

Table 8-2. UFR Climate Change Priorities

Priority	Category	Topic	Urgency	Risk
1	Water Demand	Seasonal water use variability	High	High
1	Water Supply	Snowmelt	High	High
1	Water Supply	Unmet local water demands (drought)	High	High
1	Water Supply	Invasive species	High	High
1	Water Quality	Water quality (wildfires)	High	High
1	Water Quality	Eutrophication water quality issues	High	High
1	Water Quality	Seasonal low flows and assimilative capacity	High	High
1	Water Quality	Treatment facility operations	High	High
1	Flooding	Aging critical flood protection	High	High
1	Flooding	Wildfires	High	High
1	Ecosystem and Habitat Vulnerability	Climate-sensitive fauna or flora	High	High
1	Ecosystem and Habitat Vulnerability	Recreation and economic activity	High	High
1	Ecosystem and Habitat Vulnerability	Quantified environmental flow requirements	High	High
1	Ecosystem and Habitat Vulnerability	Top habitat vulnerable to climate change	High	High
2	Water Demand	Unmet in-stream flow requirements	Medium	High
3	Water Demand	Climate-sensitive crops	Medium	Medium
3	Water Demand	Groundwater drought resiliency	Medium	Medium
3	Water Demand	Water curtailment effectiveness	Medium	Medium
3	Water Quality	Unmet beneficial uses	Medium	Medium
3	Flooding	Critical infrastructure in a floodplain	Medium	Medium
3	Flooding	Insufficient flood control facilities	Medium	Medium
3	Ecosystem and Habitat Vulnerability	Erosion and sedimentation	Medium	Medium
3	Ecosystem and Habitat Vulnerability	Endangered or threatened species	Medium	Medium

Priority	Category	Topic	Urgency	Risk
3	Ecosystem and Habitat Vulnerability	Fragmented habitat	Medium	Medium
3	Hydropower	Electricity source	Medium	Medium
4	Water Supply	Supply surplus carryover	Low	Medium
5	Water Demand	Cooling/process water for industry	Low	Low
5	Water Supply	Climate-sensitive water supply	Low	Low
5	Hydropower	Growing energy needs	Low	Low

8.5 Further Data Gathering and Analysis of the Prioritized Vulnerabilities

Proposition 84 guidelines requires that this IRWMP "contain a plan, program, or methodology for further data gathering and analysis of the prioritized vulnerabilities." The method to fulfill this requirement is located in Chapter 11 *Plan Performance, Monitoring, and Data Management*.

8.6 Greenhouse Gas Emissions and UFR Project Development and Selection

In addition to addressing climate change vulnerability, Proposition 84 guidelines require this IRWMP to describe how GHG emissions are mitigated and how adaptation actions are addressed. As part of the project evaluation process (Chapter 9 *Project Development and Review Process*), each project was required to identify if it addressed climate change issues. In order to say that a project had addressed climate change issues, project sponsors were required to respond to a checklist that provided high-level GHG emissions estimates for construction- and annual project operation-related GHG emissions, as well as state how the project contributed to regional resiliency as new projects are implemented over the 20-year planning horizon.

Climate change adaptation strategies are also included in this IRWMP as part of the RMS chapter. As noted above, each climate change vulnerability topic was assessed for relevant RMS. Where an RMS was identified as being relevant to climate change, the project team provided climate change considerations and further analysis. See Chapter 6 *Resource Management Strategies* for more information.

CHAPTER 9.0 PROJECT DEVELOPMENT AND REVIEW PROCESS

9.1 Introduction

The projects included in the Upper Feather River (UFR) Integrated Regional Water Management (IRWM) Plan are intended to implement the Plan and achieve Plan objectives. All projects must undergo a thorough review process before they can be formally included in the IRWM Plan. The Proposition 84 and Proposition 1 IRWM Grant Program Guidelines require that certain factors be used in the review process. These factors include:

- How the project contributes to Plan objectives
- How the project is related to resource management strategies (RMS) selected for use in the Plan
- Technical feasibility of the project
- Specific benefits to disadvantaged communities (DAC) and their water issues, including whether a project helps address critical water supply or water quality needs of a DAC
- Special benefits to critical water issues for Native American tribal communities
- Environmental justice (EJ) considerations
- Project costs and financing
- Economic feasibility, including water quality and water supply benefits and other expected benefits and costs
- Project status
- Strategic considerations for Plan implementation
- Contribution of the project in adapting to the effects of climate change in the region:
    - Include potential effects of climate change on the region and consider if adaptations to the water management system are necessary (Proposition 1)
    - Consider the contribution of the project to adapting to identified system vulnerabilities to climate change effects on the region (Proposition 1)
    - Consider changes in the amount, intensity, timing, quality, and variability of runoff and recharge (Proposition 1)
    - Consider the effects of sea level rise on water supply conditions and identify suitable adaptation measures (Proposition 1)
- Contribution of the project in reducing greenhouse gas (GHG) emissions as compared to project alternatives:
    - Consider the contribution of the project in reducing GHG emissions as compared to project alternatives (Proposition 1)
    - Consider a project's ability to help the IRWM region reduce GHG emissions as new projects are implemented over the 20-year planning horizon (Proposition 1)
    - Reducing energy consumption, especially the energy embedded in water use, and ultimately reducing GHG emissions (Proposition 1)
- Whether the project proponent has adopted (or has committed to adopting) the IRWM Plan

With each new project solicitation for the IRWM Plan, the Regional Water Management Group (RWMG) will meet to review the implementation projects for eligibility. The RWMG will 1) ensure that projects meet 'minimum standards' (Table 9-1) for inclusion in the Plan, 2) seek opportunities for integration, and 3) determine whether they meet the IRWM Plan objectives, as well as the objectives and priorities of the

IRWM Grant Program. The result of this process will be a vetted project list, approved by the RWMG. All projects on the implementation project list have been reviewed and are considered by the RWMG as eligible for IRWM grant funds.

The following sections describe the project review process, per the Proposition 84 and Proposition 1 IRWM Grant Program requirements outlined above.

9.2 Project Development

9.2.1 Project Solicitation and Submission

To be considered in the IRWM Plan, a two-step process was initiated. Project proponents first submitted conceptual projects for an initial vetting and secondly, submitted a project application for consideration. The UFR IRWM website contains information about the project submittal process, how projects will be evaluated, and instructions for how to submit. Select information about the projects is included in an online GIS-linked searchable database on the website. The project submission form was developed in accordance with DWR's IRWM Guidelines, with the purpose of collecting information needed to comply with the specified project review process. The requested information included:

- Project sponsor/proponent information
- Location description
- Partners
- Stakeholder involvement
- Regional objectives met
- Program preferences met
- Statewide priorities met
- RMS used
- Status
- Costs and funding
- Addressing needs of DACs, EJ, climate change
- Data management

To get an initial list of projects, the RWMG initiated a formal "Call for Projects" from April 7 through June 1, 2015 (Appendix 9-1). Additionally, two public project solicitation meetings were held, on May 5, 2015 in Chester and on May 6, 2015 in Portola, California (Appendix 9-1). The RWMG met to discuss the conceptual projects on June 15, 2015, and provided initial feedback to project proponents to consider in their development of the Step 2 Project Information Forms (PIF) (Appendix 9-2). The deadline for submittal of the Step 2 PIFs was August 3, 2015. A total of 81 projects from 29 different proponents were gathered during this period, 79 of which were included for this Plan analysis. Additional calls for projects will occur as needed and in response to future IRWM implementation funding opportunities. This flexibility is encouraged since packages of projects are more likely to result in integrated and multi-objective approaches.

9.2.2 Targeted Communities: Project Development Process

9.2.2.1 Tribal

The Tribal Advisory Committee (TAC) members were active partners in the development of potential projects and held numerous meetings of targeted discussions, presentations by staff, and development of Tribal projects. The Project Team's Tribal Outreach staff met and communicated with Tribal members on numerous occasions to support and encourage development of Tribal projects. Four projects were ultimately developed and submitted to the RWMG for consideration. A theme that emerged during discussions with the TAC was integration of Traditional Ecological Knowledge (TEK) with implementation projects throughout the region. The TAC actively identified potential integration of TEK into all implementation project submittals (Table 9-2) and has offered to coordinate with those identified project proponents as they further develop their projects for funding opportunities.

9.2.2.2 Disadvantaged Communities

Addressing critical water supply needs of disadvantaged communities (DACs) was an objective of the project development process, and was addressed primarily through the Municipal Services Workgroup. Within the Municipal Services Workgroup, water supply managers throughout the region identified projects that could address critical supply issues. Additionally, even if a DAC was not actively involved in the Municipal Services Workgroup, its community service district or municipal representative was personally contacted by staff to help the DAC identify projects for consideration in the Plan. An outcome of these efforts included identification of projects addressing aging infrastructure, water quality, wastewater, and additional water storage for DACs throughout the region.

9.2.3 Integration Process

The IRWM Guidelines specifically require that integration be considered during project review. Integration was interpreted to mean an intentional review of projects to determine opportunities for coordination in order to develop complementary projects that generate multiple benefits and/or meet multiple Plan objectives. This was not meant to preclude the inclusion of single stand-alone projects, but rather to ensure that the importance of achieving multiple and quantifiable implementation objectives and benefits is held as a Plan standard.

Project integration included several specific and intentional considerations or standards:

1. Geographic: Under this standard the integrative principle is geographic location. Projects would be looked at based on their location within the watershed, for instance, Sierra Valley. This principle might result in the integration of multiple projects of different types, all of which benefit a geographical area.
2. Project Type: Early on in the conceptual project process it became clear that there were definite ‘types’ of projects such as community infrastructure, meadow restoration, fuel and fire reduction, and irrigation efficiency. Using this principle, all projects that address a particular issue could be looked at as a group and opportunities to aggregate, merge, or identify compatible projects were evaluated. This project type option might generate a set of water tank installation or repair projects or a set of water distribution system improvement projects. The projects might generate similar benefits in multiple locations. For example, the regional thinning project (Appendix 9-3), in which a region-wide forest fuels reduction effort would result in multiple benefits throughout the region, includes decreased wildland fire potential, increased groundwater infiltration benefits, and increased biomass sources for alternative energy production.
3. Plan Goals/Objectives: Under this standard the integrative principle focuses on aggregating or organizing projects by the goal/objective they most closely align with. This offers an opportunity to identify projects that meet multiple goals or objectives, as well as multiple projects that address a specific goal/objective. At some point, project sponsors may wish to aggregate projects that, for instance, address wet-meadow restoration to meet objectives on sediment reduction and habitat improvement.

After much deliberation, the RWMG determined that all three types of integration should be considered during its efforts to develop a coherent and high-value set of projects for Plan inclusion, without any single principle taking precedence. As a result, an additional decision was made to include projects in the Plan in two distinct ways: 1) via a listing of individual projects and 2), via creation of project 'suites' or 'bundles.' In this way, project sponsors maintained their own distinct project descriptions and outcomes, and were also able to work with other sponsors to develop aggregations of projects that yielded multiple benefits and met multiple Plan objectives (Chapter 5 *Goals and Objectives*; Table 5-6).

The integration process then advanced to the next stage. A half-day integration workshop held on August 21, 2015 focused on bringing the workgroups and stakeholders together to present and discuss project submittals and integration opportunities. Feedback from the workshop was presented to the RWMG at its September 23, 2015 meeting; staff was asked to further develop integration opportunities. Building on the workshop and RWMG discussions, staff evaluated all of the Step 2 PIFs to further identify opportunities for integration, which were noted with key words that could be easily sorted depending on future funding opportunity.

9.3 Project Review Process

The DWR IRWM Plan Guidelines require a process or processes to select projects for inclusion in the IRWM Plan. The selection process(es) must include the following components:

- Procedures for submitting a project to the RWMG
- Procedures for reviewing projects considered for inclusion into the IRWM Plan
- Procedures for displaying the list(s) of selected projects
- How the project contributes to the IRWM Plan objectives
- How the project is related to resource management strategies selected for use in the IRWM Plan
- Technical feasibility of the project
- Specific benefits to DAC and Tribal water issues
- Environmental justice considerations
- Project costs and financing
- Climate change analysis
- Greenhouse gas emissions analysis

The RWMG's process to collect, review, and maintain the region's list of projects that addressed all the requirements set forth in the IRWM Guidelines was presented and ultimately accepted at a series of public workgroup and RWMG meetings, held March through September 2015.

9.3.1 Project Review Factors

According to IRWM Guidelines, certain review factors must be considered in the project review process, and when selecting projects for inclusion in the IRWM Plan (Table 9-1). A description of how each factor was considered in the project evaluation process is provided.

Table 9-1 Upper Feather River IRWM Plan implementation project review criterion

Topic	Approach in evaluation process
Technical feasibility	Technical feasibility is a review factor in project screening. All projects were evaluated for technical feasibility in early project screening; all projects submitted were technically feasible.

Topic	Approach in evaluation process
Benefits critical water issues to DACs	Benefit to DACs is included as a project review factor, as part of assessing the project's ability to address additional IRWM guideline review factors. There are many opportunities for projects to benefit DACs.
Benefits critical water issues to Native American tribal communities	Benefit to Native American tribal communities is included as a project review factor, as part of assessing the project's ability to address statewide priorities. However, no critical water supply issues were identified by the TAC during this initial "Call for Projects". A future proposal may include something benefiting tribal communities; for example, enhancement of habitat suitable for plants that may be used for cultural purposes.
Environmental justice considerations	Environmental justice considerations are included as a project review factor, as part of assessing the project's ability to address additional IRWM Guidelines review factors.
Project costs and financing	Project costs and financing are included as implementation considerations.
Economic feasibility	Economic feasibility is included as an implementation consideration.
Project status	Project status is included as an implementation consideration.
Strategic considerations for IRWM Plan implementation	Strategic considerations were considered during project screening. Strategic considerations for combining or modifying local projects into collaborative regional projects were considered during an integration workshop (August 2015); the workgroup coordinators further identified opportunities for modifications and integration, and initiated discussions directly with the project proposer(s). If project modifications were agreeable, the project was modified. This occurred during the final phase of project evaluation.
Project adaptations for climate change	Climate change adaptation is included as a project review factor, in assessing the project's ability to address regional objectives and statewide priorities. Climate change is also its own standard in the IRWM Plan.
Greenhouse gases	An initial assessment of project generation and impact of GHG is included as a project review factor (see project GHG analyses in Appendix 9-2)
Plan adoption	Whether or not the project sponsor had signed the MOU for the IRWM Plan Update was a review factor in determining whether a project was included in the Plan.
Reliance on Delta	Not applicable. The UFR Region is a headwaters watershed and has no reliance on the Delta.

9.3.2 *Project Review Steps*

After Step 2 project information forms were received and review criteria developed, the process for reviewing projects and programs within the UFR Region involved the following sequential steps:

1. **Perform initial screening of projects for inclusion** – Projects were screened for their relevance to water management and technical feasibility before being included in the IRWM Plan. No projects were eliminated at this step.
2. **Review benefits claimed by each project** – Text entries were required in the project submission form to justify why certain benefits were claimed, in particular for those related to the regional objectives and resource management strategies. The workgroup coordinators reviewed these explanations to verify that the project proposers understood the intent and that their benefit claims seemed reasonable before those benefits were accounted for in the evaluation of projects.
3. **Project integration and coordination** – Opportunities were sought to combine, evaluate, expand, and/or modify projects to achieve multiple benefits, expand local benefits on a regional scale, and/or enhance projects to address more regional objectives. For example, two similar projects that are geographically adjacent could be combined into a single effort to maximize implementation efficiency, or a project could be modified to include more comprehensive DAC benefits and outreach.

9.3.3 *Ranking and Scoring*

Over the course of several meetings, the RWMG determined it did not want to conduct an overall project prioritization or ranking process so as to encourage and focus on collaboration and integration within the region. In so doing, the RWMG determined that collaboration and integration are critical to maximizing benefits to the watershed through strategically aligning opportunities, particularly in the face of limited financial resources. Further, in supporting collaboration over competition among project proponents it reduced conflict and actively demonstrated the benefits of a multi-strategy approach.

With integration and collaboration as overriding principles for long-term stewardship, prioritizing implementation projects was deemed counterproductive. The RWMG determined at every opportunity to emphasize collaboration, and not competition, for limited resources, both in financial and human capital. The RWMG determined that when a grant opportunity arises, the RWMG might choose to first score projects using a general scoring criteria. Projects that scored higher would then be further ranked, against a group of similar project types (e.g., restoration, irrigation efficiency). The highest scoring projects for that funding source would then be considered for integrative opportunities that best fit the grant/source.

9.3.4 *Documenting the Projects*

For the purposes of this IRWM Plan Update, an initial list of projects was submitted and reviewed. The reviewed projects, listed by sponsoring agency/organization, are summarized in Table 9-2 and can be viewed on the UFR IRWM website. Full details about these projects may be found in Appendix 9-3. Note that the numbering of the projects in Table 9-2 bears no relationship to rank or priority; instead, the numbers relate to a project's order in the database. Projects in the table below are sorted by type of project: Agricultural Land Stewardship (ALS); Floodplains, Meadows, Waterbodies (FMW); Municipal Services (MS); Tribal Advisory Committee (TAC); and Uplands Forest (UF).

Table 9-2 Implementation Projects for the Upper Feather River IRWM Plan

Sponsoring Agency/Proponent	Project Number/Title	Estimated Budget ($)	Benefits a Disadvantaged Community	Tribal Integration (TEK)	Regional Project
Feather River Resource Conservation District	ALS-1:Taylorsville Mill Race Dam resurfacing	150,000			
Feather River Resource Conservation District	ALS-2: Water quality and infrastructure upgrades on working lands	1,567,500			X
Feather River and Sierra Valley Resource Conservation Districts	ALS-3: Enhanced management of livestock grazing	1,500,000			X
Plumas and Sierra County Agricultural Commissioner	ALS-4: Invasive weed management	450,000		X	X
Sierra Valley Resource Conservation District	ALS-6: Sierra Valley agricultural water diversion efficiency and improvements	150,000			
Sierra Valley Resource Conservation District	ALS-7: Sierra Valley Resource Conservation District Resource Management Plan	155,000	X		X
Feather River Resource Conservation District	ALS-8: Upper Feather River weather monitoring infrastructure	380,200			X
University California Cooperative Extension	ALS-9: Soil health assessment	580,000-800,000			X
Sierra Valley Groundwater Management District	ALS-10: Sierra Valley Groundwater Sustainability Plan	572,000	X		

Sponsoring Agency/Proponent	Project Number/Title	Estimated Budget ($)	Benefits a Disadvantaged Community	Tribal Integration (TEK)	Regional Project
Sierra Valley Resource Conservation District	ALS-11: Cold Stream Ag & Fire Storage Impoundment	300,000	X		
Sierra Valley Resource Conservation District/University California Cooperative Extension	ALS-12: Alfalfa alternative	130,000			X
Sierra Valley Groundwater Management District/Sierra Watershed Habitat Conservation Foundation	ALS-13: Little Last Chance Lake	265,000		X	
Lake Almanor Watershed Group	FMW-2: Water quality monitoring program for Lake Almanor and its tributaries	120,000		X	
Mountain Meadows Conservancy	FMW-4: Wildlife enhancement project	238,062		X	
Mountain Meadows Conservancy	FMW-5: Upper Feather River Interpretive and Education Sites	60,500			
Natural Resources Conservation District	FMW-6: Watershed monitoring program	40,000			
County of Plumas	FMW-8: Spanish Creek restoration	1,250,000			
Plumas County Unified School District	FMW-9: Watershed education	48,000	X		
Lake Almanor Watershed Group/Sierra Institute	FMW-10: Lake Almanor Basin stewardship and outreach program	142,224	X	X	

Sponsoring Agency/Proponent	Project Number/Title	Estimated Budget ($)	Benefits a Disadvantaged Community	Tribal Integration (TEK)	Regional Project
Lake Almanor Watershed Group/Sierra Institute	FMW-11: Lake Almanor Basin water quality improvement plan	510,000	X		
US Forest Service	FMW-14: Folchi Meadow project	300,000			
Trout Unlimited	FMW-15: Fish habitat assessment/restoration, public awareness/education	180,000		X	X
Trout Unlimited	FMW-16: Fish distribution modeling in relation to climate change	166,500		X	X
WM Beaty and Associates	FMW-18: Mountain Meadows livestock fencing	174,600	X		
Trout Unlimited	FMW-19: Debris dam survey, inventory and characterization	97,000			
City of Portola	MS-1: Wastewater system infrastructure improvements	1,424,522	X		X
City of Portola	MS-2: Turner Springs improvement	403,000	X		
East Quincy Services District	MS-4: Water tank project	630,000	X		
Feather River Canyon Community Services District	MS-6: Old Mill Ranch	500,000	X		
Gold Mountain Community Services District	MS-7: High elevation water tank and well	2,030,150	X		

Sponsoring Agency/Proponent	Project Number/Title	Estimated Budget ($)	Benefits a Disadvantaged Community	Tribal Integration (TEK)	Regional Project
Gold Mountain Community Services District	MS-8: Water reclamation facility	1,758,000	X		
Grizzly Lake Community Services District	MS-9: Crocker water service meters	1,500,000	X		
Grizzly Lake Community Services District	MS-10: Crocker Welch ground tank repair	200,000	X		
Grizzly Lake Community Services District	MS-11: Delleker water meters	1,500,000	X		
Grizzly Lake Community Services District	MS-12: Delleker water tank rehabilitation	200,000	X		
County of Plumas	MS-13: Groundwater monitoring	40,000	X		
County of Plumas	MS-15: Chandler Road bridge erosion	897,000			
County of Plumas	MS-16: Humbug Valley Road bridge erosion	408,000			
County of Plumas	MS-17: Road 311 culvert improvement	251,000			
County of Plumas	MS-18: Road 318 culvert improvement	251,000	X		
County of Plumas	MS-19: North Valley Road bridge erosion	670,000	X		
County of Plumas	MS-20: Mill Creek erosion	835,000	X		
County of Plumas	MS-21: Smith Creek erosion	105,000	X		

Sponsoring Agency/Proponent	Project Number/Title	Estimated Budget ($)	Benefits a Disadvantaged Community	Tribal Integration (TEK)	Regional Project
County of Plumas	MS-22: Wapaunsie Creek erosion	427,000	X		
County of Plumas	MS-23: Stampfli Land bridge erosion	432,000	X		
County of Plumas	MS-24: Walker Ranch Community Services District infrastructure improvements	100,000	X		
County of Plumas	MS-25: Humbug Valley Road 307 culvert improvement	728,000			
Plumas-Eureka Community Services District	MS-26: Municipal well No. 3	1,050,000			
Plumas-Eureka Community Services District	MS-27: Treated wastewater reuse	N/A	X		
Plumas-Eureka Community Services District	MS-28: Water meter installation	989,205			
Plumas-Eureka Community Services District	MS-29: Water storage tank replacement	531,750			
Plumas-Eureka Community Services District	MS-30: Wastewater treatment plant No. 6 upgrade	N/A			
Plumas-Eureka Community Services District	MS-31: Wastewater treatment plant No. 7 lift station replacement	N/A			

Sponsoring Agency/Proponent	Project Number/Title	Estimated Budget ($)	Benefits a Disadvantaged Community	Tribal Integration (TEK)	Regional Project
Quincy Community Services District	MS-32: Water system improvements	589,000	X		
County of Sierra	MS-33: Sierra County road improvements	495,000			
Sierraville Public Utilities District	MS-35: Alternative water storage analysis and development	660,000	X		
Westwood Community Services District	MS-36: Water storage project	750,000	X		
Lake Almanor Watershed Group/Sierra Institute	MS-37: Almanor Basin solid and wastewater treatment plant	135,000	X	X	
Sierraville Public Utilities District	MS-38: Leak detection and repair	155,500	X		
Sierraville Public Utilities District	MS-39: Meter replacement	194,000	X		
Sierraville Public Utilities District	MS-40: Pumphouse improvement	243,400	X		
Sierraville Public Utilities District	MS-41: Tank replacement project	630,000	X		
East Quincy Services District	MS-42: Automatic meter reading project	666,679	X		
East Quincy Services District	MS-43: Replace copper service lines project	1,107,685	X		
Maidu Summit Consortium	TAC-2: Big Springs vegetation management	400,000		X	
Maidu Summit Consortium	TAC-3: Mud Creek habitat recovery	450,000		X	

Sponsoring Agency/Proponent	Project Number/Title	Estimated Budget ($)	Benefits a Disadvantaged Community	Tribal Integration (TEK)	Regional Project
Maidu Summit Consortium	TAC-5: Indian Jim River Resource Center	350.000	X	X	
Maidu Summit Consortium	TAC-6: Tradition Ecological Knowledge	200,000		X	X
University of California, Cal Poly	UF-1: Marian Meadow	55,000		X	
Collins Pine Company	UF-2: Rock Creek meadow restoration	180,000		X	
US Forest Service	UF-6: Round Valley/Keddie hand thin	189,000	X		
US Forest Service	UF-7: US Forest Service road improvements	1,000,000			X
WM Beaty and Associates	UF-8: Goodrich Creek biomass	715,600		X	
WM Beaty and Associates	UF-10: Greenville Creek biomass	345,630		X	
WM Beaty and Associates	UF-11: Mountain Meadows Creek biomass	435,230		X	
Soper Company	UF-12: Upper Feather River cooperative regional thinning	50,400-52,920		X	X
County of Plumas	UF-13: Upper Feather River cooperative LiDAR and GIS support program	3,000,000-4,000,000		X	X

9.4 Project Selection for Funding Opportunities

Whenever an IRWM Grant solicitation is announced, the RWMG must decide which projects to put forward in a grant application package on behalf of the UFR Region. Only a limited number of projects can be submitted in any one round. To make this decision, the RWMG will review the implementation project list and select:

- Only those projects that are ready to proceed.
- Only those projects whose project proponents have adopted, or have expressed a commitment to adopt, the IRWM Plan (the Proposition 84 and Proposition 1 IRWM Program Guidelines stipulate that each project proponent named in an IRWM Grant application must adopt the IRWM Plan).
- Only those projects for which project proponents are able to provide certainty of landowner support. With the resulting list of "eligible projects" from which to select for that IRWM Grant solicitation round, the RWMG will then take into consideration the following factors:

    - How well a project scored in the project ranking (to be performed with each grant solicitation)
    - Economic effects of the project
    - How well a project addresses IRWM Program preferences (Plan objectives, statewide priorities, RMS, etc.)
    - Project costs relative to the amount of IRWM funding available in that round
    - How well the various projects can be integrated to address regional needs and provide the most benefit to the region
    - The desired outcome is an application package comprising several projects that, together, will help implement the Plan objectives, will provide multiple and regional benefits for the UFR IRWM region, and will be most competitive on a state level for IRWM (and other) grant funds

The RWMG has established a process for selecting projects for funding. It is anticipated that a wide variety of funding sources will be pursued in addition to those that may be available through Proposition 1 IRWM opportunities, or any subsequent bond issue. In fact, it is the uncertainty of bond-based funding that motivated the UFR to develop a process that specifically is not exclusively DWR-focused.

Projects included in the Plan may seek non-DWR funding independently of RWMG approval. However, any project that is included in the Plan and that is submitted for non-DWR funding will be encouraged to include a line item, where possible, to cover the cost of RWMG administration and integration of the project outcomes into the Plan.

It is the intent of the RWMG that the outcome of all projects that support Plan objectives (and by incorporation, resource management strategies), regardless of funding source or their inclusion in the Plan, be reported in annual Plan performance reviews, tracked for monitoring Plan implementation, and posted on the website. The RWMG may annually query all of its members about projects to track the region's progress in meeting Plan objectives.

The selection process will proceed as follows:

1. The RWMG representative will track and research available funding options (Chapter 12 *Finance*), using a strategy developed by the RWMG. The strategy needs to include a consideration of the most appropriate funding source(s) for each project to ensure that projects with limited funding opportunities are given focused attention.

2. When a funding source is identified, the RWMG representative will review the guidelines for that funding entity and determine which of the existing projects are potentially both eligible for and competitive for that funding source.
3. Using the scoring strategy already developed and any additional scoring criteria identified in specific funding opportunities, the projects deemed consistent with the guidelines for the funding source will be ranked by the RWMG.
4. Based on the scoring results and an assessment of the overall compatibility and integration of the project(s), a recommendation will be made to the RWMG as to which projects should be bundled or included in the funding application. The RWMG will make the final determination as to inclusion in a grant proposal.
5. The RWMG and its representative will provide whatever support they can to the project sponsors as the application is readied for submittal. Unless base funding for IRWMs is established, it is expected that support will be limited to providing access to materials developed as part of the Plan process and that may support both project development and the assessment of the cost/benefit of individual projects. Should base funding be provided to IRWM regions, support may be expanded to in-kind labor for writing and reviewing the application, technical assistance in refining project descriptions or technical analysis as needed, and other similar activities.

9.5 Implementation and Updating Project Lists

As stated previously, this is an initial list of projects. With the IRWM website and planning framework established, projects may be added, removed, or updated at any time. Equipped with a 'living' process, project proponents and stakeholders now have a venue to collaborate and integrate their projects. Getting a project on the list is important, even if there isn't an imminent funding opportunity. From time to time, the RWMG and its members may feel it necessary to have another formal call-for-projects to refresh their list or to prepare for a new funding opportunity. Although funding is important, it is not the sole purpose for watershed planning. Proper integrated planning should be ongoing, open, transparent, and collaborative. For instance, a number of additional and ongoing planning efforts within the UFR Region provide excellent opportunities for regional integration and stakeholder involvement.

The project list for 2016 IRWM Plan implementation projects is provided in Table 9-2; full submittals are included in Appendix 9-3. The IRWM Plan project list will evolve with each new project solicitation (anticipated to occur on an annual to bi-annual basis, contingent on the Proposition 1 IRWM Grant solicitation schedules). Appendix 9-3 will be updated whenever a new project list is generated. Updating this appendix will not entail formal re-adoption of the Plan, but just the approval (i.e., simple majority vote) of the RWMG. The project lists (and updates) will be announced to stakeholders via email, and will also be available for download on the UFR IRWM website at http://featherriver.org/proposed-projects/.

CHAPTER 10.0 IMPACTS AND BENEFITS

10.1 Introduction

This chapter presents a screening-level analysis of impacts and benefits expected from the implementation of the Upper Feather River Integrated Regional Water Management (IRWM) Plan. The purpose of a screening-level analysis is to serve as a general overview of the potential impacts and benefits of implementing the Plan at a regional level. For purposes of this discussion, *benefits* are effects that are expected to represent positive change or improvement over existing conditions while *impacts* are defined as effects that are expected to represent negative or deleterious change from existing conditions.

Effects are separated into Plan-level and project-level impacts and benefits. *Plan-level effects* are those that accrue through implementation of the Plan itself and are not associated with the direct, physical effects of an individual action; they are by nature administrative and process-oriented, and regional in scale. *Project-level effects* stem from individual projects or actions that are typically local in scale although they might have regional implications or have a cumulative regional effect, and are usually associated with direct, physical effects. The goals and objectives of the Plan generally reflect the intended benefits of Plan implementation, and include both Plan-level and project-level benefits (Chapter 5 *Goals and Objectives*).

Because the list of implementation projects may change as the IRWM planning effort proceeds, it is not practical to provide a project-level analysis of impacts and benefits within the IRWM Plan. Therefore, the analysis presented in this chapter is not intended to be comprehensive or exhaustive. Prior to implementation of any individual project approved under this Plan, a project-level analysis will occur in conformance with regulatory processes required by applicable statutes such as the California Environmental Quality Act (CEQA, with conditional exceptions for CEQA review of habitat restoration projects under five acres) and the National Environmental Policy Act (NEPA). A detailed description of the timing and process for ensuring adequate environmental analysis at a project level can be found elsewhere (Chapter 9 *Project Development and Review Process)*.

The impacts and benefits discussed in this chapter will serve as benchmarks for evaluating Plan performance (Chapter 11 *Plan Implementation, Performance, and Monitoring)*. This Impacts and Benefits chapter will be reviewed and updated in light of the Plan's performance data and changes to associated projects.

10.2 Plan-level Impacts and Benefits

10.2.1 Plan-level Benefits

10.2.1.1 Fostering Understanding and Information Sharing Within the Region

One of the five goals of the IRWM Plan is to "Establish and maintain effective communication among water stakeholders." While the Region has a long history of collaborative watershed restoration and management efforts, development of this Plan fostered greater diversity in those collaborations, particularly inclusion of individuals and entities whose interests are affected by project implementation. Examples include restoration projects in upland watersheds that affect downstream availability of water, and insufficient sharing of monitoring information and results. Additionally, the Upper Feather River Regional Water Management Group (RWMG) includes a representative from the Maidu Summit Consortium, a non-profit group representing nine member organizations of Maidu Indians of Lassen and Plumas Counties. The Tribal participation in this planning effort has many benefits including collaboration in the process at both the management and workgroup level of the UFR IRWM Plan; development of implementation projects, including 'beneficial uses' and Traditional Ecological Knowledge (TEK); and integration of tribal knowledge and values with numerous implementation projects presented in the Plan.

The Plan establishes a framework for governance that includes a memorandum of understanding with existing federal, state, local, non-governmental, and private industry entities in the Plan area. The Plan ensures continued stakeholder participation in Plan and project implementation through workgroups. In addition to stakeholder outreach efforts, the Plan engages in targeted outreach to Disadvantaged Communities (DAC) and Native American tribes. It includes a communication plan for sharing methods, technology, and scientific data (Chapter 11 *Plan Implementation, Performance, Monitoring, and Data Management*).

10.2.1.2 Opportunities to Collaborate on Project Development and Solving Regional Issues

The IRWM Plan provides an integrated approach to identifying and solving water management issues throughout the watershed. Since 1985, the Feather River Coordinated Resource Management (FRCRM) partnership has enhanced communication between federal, state, and local agencies and outreach efforts to private landowners; created successful collaborations in securing grant funds for the watershed; implemented numerous projects; piloted large-scale meadow restoration projects with innovative techniques; and established and maintained a stream monitoring network for flow and temperature.

The FRCRM was recently reorganized as the Upper Feather River Watershed Roundtable, a collaborative, non-regulatory partnership that involves the active participation of county, state and federal agency representatives, local stakeholder groups, and environmental organizations working together to achieve the enhancement of water quality, water quantity, and aquatic, riparian, and meadow habitat in the Upper Feather River Watershed. The Roundtable is composed of local, state, and federal entities that were signatories to the FRCRM group. Another organization in the Region – the Plumas Watershed Forum (PWF) formed in 2003 as a result of the Monterey Settlement Agreement – has performed similar functions: administering funds dedicated to watershed restoration and funding high-priority projects that have demonstrated positive results in improving watershed retention and reducing sedimentation.

The IRWM Plan extends that type of watershed-scale integration to infrastructure, municipal services, forest management, and economic needs, as well as complementing the environmental restoration progress already made in the watershed. The IRWM Plan includes similar stakeholder coordination at the Plan- and project-implementation levels through participation in the workgroups and Regional Water Management Group. The Plan also provides benefits through coordination of data and information sharing that will help identify areas of need in the Region and facilitates increased economies of scale through sharing of equipment, expertise, and labor.

10.2.1.3 Identification of Diverse Funding Sources

During its development, the Plan has concentrated on identifying program-level and project-level funding sources to further the achievement of the goals and objectives of the Plan (Chapter 12 *Finance)*. The Plan has identified a need for increased capacity to pursue funding by combining grant writing and administrative functions in the Region a need shared with other rural IRWM regions throughout the state. Implementing the IRWM Plan will increase the likelihood of securing funding by demonstrating to funding entities that individual projects are part of an integrated regional program that includes coordinated projects, demonstrates collaboration among stakeholders, and provides for technical data sharing and cost-saving opportunities.

10.2.1.4 Capacity Building

One of the challenges facing the Upper Feather River Region is the issue of capacity to address issues regarding water resources. The small, widely dispersed population of the Plan area makes capacity an especially difficult challenge in the Upper Feather River Region compared to more populous, affluent, and urban regions. Municipal service providers and small districts face a shortage of qualified operators as staff retires, and can have difficulty finding enough people to serve on a board of directors. Private land managers often lack the expertise, knowledge, and time to seek funding and guidance to support projects to manage their lands.

Supporting coordinated planning, project development, funding, monitoring, data management, and administration efforts among the numerous agencies, individuals, entities and local districts in the Region may, through economies of scale or less duplication in individual efforts, make more resources available to all. Building capacity in the Region through integration of water management activities throughout the Plan area is a function of seeking funding for increasing expertise and administration efficiencies and for investing in building the capacities for implementation partnerships by project proponents with other agencies and organizations. This would especially benefit communities that currently have little or no capacity to pursue grants and projects to meet their water management needs. As discussed previously, the adopted IRWM Plan will also increases the likelihood of submitting successful grant applications that reflect the needs of the multiple community and water needs in the region.

10.2.1.5 Venue to Address Policy-related and Regulatory Processes

The workgroups have identified several issues in the UFR Region regarding regulatory requirements that affect local agencies and individuals. These issues include:

- increasingly stringent requirements on municipal service providers regarding water quality, while many of the groundwater aquifers in the Region carry high levels of arsenic and other metals from both natural sources and historic mining activities;
- requirements on municipal water districts to ensure that all private wells in their service areas are properly located, in a region where a very large proportion of residents rely on private wells that predate modern regulations;
- requirement for the Sierra Valley Groundwater Management District to develop a sustainable groundwater management plan in accordance with the new state groundwater management regulations;
- Forest Service regulations for public grazing lands; requirements for road and stream crossings, and management of springs for domestic water, for wildlife and wildfire fighting needs, and as areas of special importance for tribes;
- Central Valley Regional Water Quality Control Board conditional waivers of waste discharge requirements for agricultural operations in the Region that are tied to overall watershed water quality that is affected by sources of pollution other than agriculture; and
- Air Quality regulations for managed fire and disincentives for biomass utilization of woody debris for power generation.

The Plan provides a venue for discussion of these issues and a framework for identifying collaborative, regional solutions. Such collaborative, regional proposals are more likely to succeed than proposals from individual entities.

10.2.2 Plan-level Impacts

Plan-level impacts from implementation of the IRWM Plan will derive from increased responsibility to fund and administer the Plan itself. After the Plan is developed the RWMG is dedicated to meet quarterly, and will be responsible for organizing and documenting meetings, conducting outreach, coordinating project development, and maintaining public information services such as the IRWMP website (http://featherriver.org/). Further, implementation of the Plan will require additional volunteers in the community to attend meetings, serve on workgroups, and support public outreach efforts. Local governments and service districts in the Plan area already rely heavily on an informal "town hall" style of personal relationships and volunteerism that would likely be taxed further by implementation of the Plan.

10.3 Benefits and Impacts for DACs and Native American Tribes

As discussed in Chapter 3 *Region Description*, many of the population centers in the Plan area (Cities and Census Designated Places) meet the Department of Water Resources (DWR) definition of a DAC: those having a median household income less than 80 percent of the statewide average. Disadvantaged and Native American communities are often excluded from policy-making processes, which leads to an unequal distribution of environmental issues within those communities. Issues of unequal distribution of environmental benefits and burdens, according to socioeconomic metrics, are collectively referred to as issues of 'environmental justice.'

Native American tribes are represented through the Maidu Summit Consortium, which represents nine member organizations of Maidu Indians of Lassen and Plumas counties. A tribal member sits on the RWMG and tribal representatives are active in some of the workgroups. Participation by Native American tribes has benefited the overall IRWM Plan substantially: cultural values have been incorporated into Plan language; educational and restoration implementation projects have been developed; and identification of Maidu tribal beneficial water uses and Traditional Ecological Knowledge (TEK) has elevated awareness and tribal consultation has been integrated into numerous implementation projects.

The Region as a whole is considered disadvantaged on a Census Tract level; at the Census Place level, there are numerous DACs throughout the Region Substantial outreach efforts to DACs were included in the Plan update process, and 79 implementation projects potentially benefiting DAC communities have been identified. Additionally, the Plan update included a Community Vulnerability Study (Appendix 10-1) that assessed the vulnerability of wells to nitrate pollution risks and to municipal and domestic drinking water in high groundwater table areas with septic systems and agricultural livestock production. Further, under the Plan, all projects will be analyzed for their effects on environmental justice and disproportionate impacts to DACs and Native American communities. For example a Tribal Advisory Committee (TAC) project addresses the remediation and redevelopment of a "brownfield[1]" site (the "Indian Jim" school property and the James Lee Campground) for cultural and environmental education, with ancillary benefits for the severely DAC subregion of the Feather River Canyon.

10.3.1 Benefits to DACs and Native American Tribes

The goals and objectives of the Plan are central to the project development and review processes, as well as to the Plan monitoring and assessment processes. One of the five goals of the IRWM Plan is to

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[1] "Brownfield" is defined by the U.S. Environmental Protection Agency as real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.

"…provide healthy and adequate water and wastewater treatment for all citizens," and one of its 18 objectives is to "Address water resources and wastewater needs of Disadvantaged Communities (DACs) and Native Americans."

Development of the Plan includes outreach to DACs and Native American communities (Chapter 2 *Governance, Stakeholder Involvement, Coordination*). Implementation of the Plan will include involvement of DACs and Native American communities (Appendices 2-2 and 2-3). Project development and review includes targeting projects to DACs and tribal communities (Chapter 9 *Project Development Process*).

Benefits to DACs and Native American communities from implementation of the Plan and associated projects would include improved safety and reliability of drinking water; improved wastewater treatment; improved flood control; and decreased risk of wildfire. Other benefits include ecosystem restoration (e.g., water quality, fisheries and wildlife habitat, meadows, forest health); cleanup of polluted mine sites; improved recreational opportunities; economic opportunities from a re-invigorated forestry industry (i.e., stand thinning, value-added small-diameter wood products, biomass power generation); and increased representation in regional policy-making.

During the project development stage of the Plan, the Tribal Advisory Committee identified two cultural goals for projects: beneficial uses and traditional ecological knowledge. Extensive coordination efforts have resulted in incorporating these goals into the development of numerous Plan projects.

- Beneficial uses refers to those uses that support the cultural, spiritual and traditional lifeways of California Indian Tribes, Tribal communities and families. Beneficial uses of water include but are not limited to those that support fish consumption, aquatic and wildlife habitat for plant and animal species, recreation, and the water quality and quantity needed to support such systems and activities.
- Traditional Ecological Knowledge (TEK) refers to the knowledge, innovations, and practices of indigenous and local communities. Traditional knowledge has developed from experience gained over the centuries and adapted to the local culture and environment. Tribes, Tribal organizations, and cultural traditional ecological practitioners have collaborated to integrate and apply TEK.

The UFR RWMG endorses the opportunity for all project proponents to enrich their projects through the inclusiveness of the whole community and therefore to reach the Maidu family(s) with traditional stewardship responsibilities and ties to the project locations and to project impacts and benefits.

10.3.2 Impacts to DACs and Native American Tribes

Impacts to DACs and Native American communities from implementation of the Plan would most likely take the form of short-term effects of project construction and monitoring. These effects would likely include dust, noise, traffic disruption, night lighting, temporary interruption of services, temporary loss of access to recreational resources, ground disturbance, erosion and sediment discharge and changes to vegetation. Project development would include implementation of Best Management Practices (BMPs) to avoid or minimize temporary impacts. Permanent impacts from Plan implementation could include changes to U.S. Forest Service road management, which will be vetted through the planning process for "Travel Management Planning, Subpart A." Implementation of municipal projects might also result in water and wastewater rate increases; however, the IRWM process is specifically intended to facilitate outside funding to alleviate the financial burdens on DACs.

Project-level impacts could fall disproportionately on DACs and Native American communities, as projects may be concentrated in those areas based on existing needs. However, as discussed above, impacts and mitigations are expected to be designed and implemented in ways that are responsive to any DAC and tribal concerns, are expected to be temporary, and will be far outweighed by long-term benefits.

10.4 Project-level Impacts and Benefits

Because the project selection and development process is ongoing and identified projects are in varying phases of development, a comprehensive list of Plan-associated projects is not available. Therefore, project-level impacts and benefits are discussed in terms of the Plan's goals and objectives. A wide variety of projects will be implemented over time to accomplish the goals and objectives of the Plan. Table 10-1 summarizes the expected potential benefits and impacts from implementing these types of projects.

10.4.1 Project-level Benefits

Project-level benefits are expected to correspond closely with the goals and objectives of the UFR IRWM Plan. While benefits may principally accrue locally, and may extend downstream, there may be cumulative benefits throughout the Plan area. Project-level benefits would include improved water quality and water supply reliability for municipal and agricultural users; alleviation of critical public health and safety problems; greater resilience to climate change; improved environmental health of the entire watershed including uplands health and greater groundwater retention; secure and efficient water and wastewater infrastructure; enhanced economic opportunities and long-term economic viability. Other benefits would include improved communication, involvement, and information sharing among stakeholders; coordination of land use and water resources planning like forest management and recycled water sharing; and reduced threat of catastrophic wildfires. Benefits would also include improved coordination with outside agencies and utilities with facilities in the Region (such as DWR and Pacific Gas & Electric [PG&E]) that increase local resource and economic benefits; and increased capacity for improving water management, including obtaining grant funding, effective project implementation and fiscal administration, and ongoing project and program evaluation and effectiveness.

10.4.2 Project-level Impacts

Project-level impacts are expected to be mostly localized and temporary, like those for DAC and Native American communities. All projects will be subject to CEQA/NEPA review, and will include avoidance and mitigation measures to minimize impacts, as necessary. Some projects, such as feasibility studies, public education and outreach, and BMP implementation, are not expected to result in environmental impacts.

Project-level impacts would likely include short-term, localized effects such as dust, noise, traffic disruption, night lighting, temporary interruption of services, temporary loss of access to recreational resources, vegetation removal and ground disturbance, temporary reductions in stream flow or quality. Long-term impacts could result in higher costs for road system management, constraints such as best management practices for some land use activities, water and wastewater rate increases, or regulatory changes.

10.5 Impacts from Failure to Implement the Plan

As part of the Plan development process, workgroups identified 67 issues in the Plan area that affect upland forested watershed lands, meadows and streams, agricultural land stewardship, and municipal services. These issues cover a broad range of challenges to the Upper Feather River Watershed, including:

- Capacity of institutions and individuals to secure funding, provide necessary services, and manage lands;

- Safety and supply of drinking water;
- Aging and inadequate water, wastewater, and flood control infrastructure;
- Lack of coordination, data sharing, and transparency among agencies and projects;
- Degraded meadows and drought-stressed forests resulting from reduced groundwater recharge and retention;
- Economic health of communities and working landscapes;
- Regulatory mandates;
- Stakeholder participation;
- Declining water quality;
- Loss of wildlife and fisheries habitats;
- Declining forest health and more catastrophic fire-prone forests; and
- Climate change precipitation variability, especially prolonged droughts, hotter and drier summers and reduced snowpack.

The Plan intends to address these issues through an inclusive, holistic, and integrated approach to water and resource management (Chapter 4 *Regional Water Issues*).

Failure to implement the Plan would limit the region's ability to meet the growing challenges to the social, economic, and environmental health of the Plan area. This would, in turn, result in continued and perhaps accelerated deterioration of conditions in the Plan area due to climate change, accumulating infrastructure deficiencies, unmet restoration needs, lack of economic development, and chronic capacity challenges. While environmental restoration projects would continue under some programs (e.g., Plumas Watershed Forum, the Resource Advisory Council (RAC) process for federal lands, Mountain Meadows Conservancy, and Upper Feather River Roundtable), the Plan-level benefits of improved efficiencies, integration of management and restoration efforts across all lands, inclusion of disparate stakeholder interests, infrastructure improvements, capacity building, and attention to the needs of DAC and Native American communities may not be realized. In addition, matching funds for many proposed projects carry time limits that would likely expire if the project development process provided by the Plan is not implemented. Finally, failure to implement the Plan would result in the forfeiture of the substantial investment of volunteer time and effort that has already gone into developing the Plan, such as the extensive efforts of the workgroup members and member organizations of the RWMG.

10.6 Interregional Benefits and Impacts

10.6.1 Interregional Benefits

Interregional benefits from implementation of the Plan would derive primarily from improvements to water quality and watershed health and resiliency, which inherently benefit downstream users through the DWR's State Water Project, and secondarily through a more continuous water supply through PG&E's "stairway of power" hydroelectric power development on the North Fork of the Feather River, and from interregional benefits associated with the wild and scenic portion of the Middle Fork of the Feather River.

Plan implementation would potentially result in indirect benefits outside the Region as well. Improvements to upland, riparian, and aquatic habitats in the watershed could benefit other regions through effects on the well-being of migratory species. Improvements in forest health and reduction of fuel loads would reduce the likelihood of catastrophic wildfires burning into adjacent regions. Biomass power generation from the products of forest thinning would help the state meet its renewable energy goals.

10.6.2 Interregional Impacts

Potential interregional impacts from Plan implementation are likely to be minimal. Projects that increase groundwater retention or reservoir storage capacity are intended to attenuate flows to reduce flooding, maximize groundwater storage, and extend surface flows later in the season. Because water deliveries to users downstream of the Plan area are mediated through Lake Oroville, changes in timing of releases from hydroelectric facilities that may be necessary for stream restoration or recreation uses would not affect the availability of water outside the Plan area. Changes in forest management activities in Plumas, Tahoe and/or Lassen National Forests brought about by implementation of the Plan could affect National Forest lands outside the Plan area; however, any such changes would likely be specific to lands inside the Plan area, and are intended to benefit forest management (i.e., forest thinning). The Plan does not currently include precipitation enhancement projects, but if such projects were pursued in the future, they would presumably have effects outside the Plan area that cannot presently be quantified.

Future projects associated with the Plan would be evaluated for off-site, interregional effects, as part of an environmental review and through consultation with tribal members and DAC representatives.

Table 10-1. Summary of Potential Regional Impacts and Benefits from Plan Implementation

IRWM Plan Objective	Potential Benefits[1]	Potential Impacts[2]
1 - Restore natural hydrologic functions	♦ Reduced seasonal drying of streams ♦ Improved water quality and availability during droughts ♦ Reduced peak flood intensities ♦ Reduced costs for water treatment, groundwater pumping, and flood damage repair ♦ Increased water retention in uplands and more stable stream flows ♦ Decreased sedimentation, bank erosion, and head cutting into meadows and infrastructure ♦ Reduced vulnerability to drought ♦ Increased watershed resiliency to climate change ♦ Increased quality of wetland, riparian, and in-stream habitats ♦ Improved habitat quality for special-status species and other wildlife	♦ Temporary construction-related impacts[3] ♦ Potential conflicts among water rights holders and other beneficial uses of water ♦ Possible short-term changes in surface and groundwater availability or quality
2 - Reduce potential for catastrophic wildland fires in the Region	♦ Decreased risk to life and property ♦ Reduced costs of emergency response ♦ Reduced disruptions caused by emergencies (i.e., evacuations, service interruptions, etc.) ♦ Improved revenue stream for tourism and forest products industries ♦ Economic opportunities from stand-thinning, biomass power, and value-added wood products ♦ Improved health of forested watershed lands ♦ Reduced visual blight and property values from burned landscapes ♦ Decreased emissions and health effects from catastrophic wildfires and prolonged smoke exposure ♦ Reduce potential for GHG emissions by reducing wildfire potential	♦ Increased forest density reduction activities and associated noise, smoke, dust, traffic, etc. ♦ Potential need for new/expanded and upgraded wood processing facilities ♦ Potential short-term damage to wildlife habitat ♦ Potential deleterious effects on special-status species ♦ Public controversy for some projects

IRWM Plan Objective	Potential Benefits[1]	Potential Impacts[2]
	♦ Decreased erosion and sedimentation resulting from catastrophic wildfires	
3 - Balance the needs of forest health, habitat preservation, fuels reduction, forest fire prevention, and economic activity in the Upper Feather River Region	♦ Increased health of forested watershed lands ♦ Long-term improvement of wildlife habitat ♦ Economic opportunities from stand-thinning, such as biomass power, and value-added wood products	♦ Increased logging activities and associated noise, dust, traffic, etc. ♦ Potential need for new/expanded wood processing facilities ♦ Potential short-term damage to wildlife habitat ♦ Deleterious effects on special-status species ♦ Public controversy
4 - Build communication and collaboration among water resources stakeholders in the Region	♦ Improved data-sharing, lessons learned, and technical expertise ♦ Decreased conflicts among disparate interests ♦ Increased involvement of private land owners in holistic water management projects ♦ Increased capacity for water management	♦ Potential increases to staff workload
5 - Work with the Department of Water Resources to develop strategies and actions for the management, operation, and control of State Water Project facilities in the Upper Feather River Watershed in order to increase water supply, recreational and environmental benefits to the Region	♦ Improved inter-agency cooperation ♦ Increased revenues from tourism and recreation ♦ Increased local voice in management practices by out-of-region agencies ♦ Improved environmental health in streams and lakes ♦ Improved local water supplies ♦ Improved fisheries habitat and resources ♦ Increased likelihood of salmon reintroduction to the Middle Fork	♦ Potentially increased workload for some staff
6 - Encourage municipal service providers to participate in regional water management actions that improve water supply and water quality	♦ Improved efficiencies and economies of scale ♦ Modernized facilities and increased flow capacity ♦ Reduced leakage and contamination ♦ Improved quality of drinking water ♦ Possible rate decreases ♦ Possible additional water storage	♦ Temporary construction-related impacts ♦ Possible rate increases ♦ Land use changes resulting from construction of new facilities ♦ Changes to the environment resulting from water impoundments

IRWM Plan Objective	Potential Benefits[1]	Potential Impacts[2]
7 - Continue to actively engage in Federal Energy Regulatory Commission (FERC) relicensing of hydroelectric facilities in the Region	♦ Faster completion of FERC relicensing with reduced administrative costs ♦ Avoid interruptions in service and/or employment at facilities ♦ Reduce impacts to environmental and recreational values in affected streams ♦ Reduce controversy and avoid litigation	♦ Potential increase in staff costs for coordination ♦ Potential need for additional technical studies
8 - Address economic challenges of municipal service providers to serve customers	♦ Identification of more diverse funding sources ♦ Improved services without rate increases	♦ Potentially increased workload for some staff
9 - Protect, restore, and enhance the quality of surface and groundwater resources for all beneficial uses, consistent with the Central Valley Regional Water Quality Control Board Basin Plan	♦ Reduced sedimentation ♦ Reduction of pollution from copper, arsenic, mercury, agricultural inputs, and other chemical contaminants ♦ Removal of Section 303 (d) impairment listing of regional streams, and savings in monitoring and compliance costs ♦ Improved wildlife, fisheries, and salmon habitats	♦ Temporary construction-related impacts ♦ Land use changes resulting from construction of new facilities ♦ Possible changes to water infrastructure operations, and amount and timing of water availability ♦ Potential changes to water conservation requirements during prolonged or severe droughts ♦ Potential conflicts among water rights holders
10 - Address water resources and wastewater needs of Disadvantaged Communities (DACs) and Native Americans	♦ Improved water quality and reliability for DACs and Native American communities ♦ Conservation and enhancement of beneficial water uses for tribes ♦ Increased involvement of underrepresented communities in water management decision-making and benefits ♦ Fewer environmental justice issues in underrepresented communities	♦ Temporary construction-related impacts ♦ Potential increase in staffing requirements ♦ Land use changes resulting from construction of new facilities ♦ Changes to the environment resulting from possible increases in water impoundments or other water supply or wastewater treatment infrastructure
11 - Coordinate management of recharge areas and protect groundwater resources	♦ Improved health of forested uplands ♦ Reduced conflicts through increased coordination between upstream management actions and downstream water needs	♦ Possible costs to of grazing and/or forest operations for watershed protection ♦ Possible short-term changes in surface and groundwater availability

IRWM Plan Objective	Potential Benefits[1]	Potential Impacts[2]
	♦ Restored meadows and riparian forests and reduced stream incision and head-cutting ♦ Increased groundwater supplies for irrigation and buffering fluctuations in precipitation ♦ Reduced groundwater overdraft, especially in Sierra Valley ♦ Reduced seasonal drying of streams, hillslope springs, and more reliable surface and groundwater water supplies in drought years ♦ Reliability of groundwater resources for private and municipal wells	♦ Possible increased costs of groundwater monitoring and reporting
12 - Improve coordination of land use and water resources planning	♦ Improved health of watersheds and streams ♦ Increased depth and breadth of stakeholder input into land management throughout the Plan area ♦ More efficient and effective project design	♦ Possible change in management of some road systems, campgrounds, or other recreational facilities
13 - Maximize agricultural, environmental and municipal water use efficiency	♦ Decreased water demand ♦ Reduced waste ♦ Enhanced water sharing and flexibility among users (i.e., recycled water for irrigation) ♦ Reduced risk of groundwater overdraft	♦ Temporary construction-related impacts ♦ Potential changes to water availability during prolonged or severe droughts ♦ Land use changes resulting from construction of new facilities
14 - Effectively address climate change adaptation and/or mitigation in water resources management	♦ Reduced vulnerability to climate-related changes in seasonal or overall water availability ♦ Prevent climate-related impacts to special-status species	♦ Potential conflicts among water rights holders during severe and prolonged droughts
15 - Improve efficiency and reliability of water supply and other water-related infrastructure	♦ Increased supply of municipal and irrigation water ♦ Improved water services to DACs ♦ Reduced potential for contamination of drinking water ♦ Decreased risk of damage from floods, and reduced flood insurance costs ♦ Decreased habitat degradation from bank erosion and water pollution	♦ Temporary construction-related impacts ♦ Possible increased rates ♦ Land use changes resulting from construction of new facilities ♦ Possible loss of riparian habitat for flood control

IRWM Plan Objective	Potential Benefits[1]	Potential Impacts[2]
16 - Enhance public awareness and understanding of water management issues and needs	♦ Improved water conservation and education ♦ Increased public commitment to resource stewardship ♦ Greater public involvement in planning processes and volunteer activities	♦ Increased costs of staff and materials for outreach and education
17 - Address economic challenges of agricultural producers	♦ Prevent loss of agricultural lands and related enterprises in farming communities ♦ Preserve agricultural revenue and infrastructure ♦ Preserve the rural character of agricultural valleys in the Plan area	♦ Increased use of pesticides, herbicides, and fertilizers ♦ Impacts to public lands, streams, and meadows from livestock when BMPs become too costly ♦ Changes to the environment resulting from potential water impoundments
18 - Work with counties, communities, and groups to make sure staff capacity exists for actual administration and implementation of grant funding	♦ Identification of more diverse funding sources ♦ Increased likelihood of successful grant applications ♦ Broader range of local administrative capabilities ♦ Increased administrative efficiencies	♦ Potentially greater demand on a small pool of volunteers ♦ Potentially increased workloads for some staff, which becomes unsustainable

[1]Potential benefits are considered at a screening level. This is not necessarily a comprehensive list of all specific local benefits accruing from an individual project.
[2]Potential impacts are considered at a screening level. This is not intended to be an exhaustive list of all potential impacts from an individual project; all projects will undergo CEQA/NEPA analysis as required.
[3]Temporary construction-related impacts include dust, noise, traffic disruption, night lighting, temporary interruption of services, temporary loss of access to recreational resources, vegetation removal and ground disturbance, and sediment discharge.

CHAPTER 11.0 PLAN IMPLEMENTATION, PERFORMANCE, MONITORING AND DATA MANAGEMENT

11.1 Introduction

The Department of Water Resources (DWR) Guidelines for Integrated Regional Water Management (IRWM) Plans include the standard that IRWM Plans "shall include performance measures and monitoring to document progress toward meeting Plan objectives." The intent of the Plan Performance and Monitoring Standard is to ensure:

- The Regional Water Management Group (RWMG) is efficiently making progress toward meeting the objectives in the IRWM Plan;
- The RWMG is implementing projects listed in the IRWM Plan; and
- Each project approved under the Plan is monitored to comply with all applicable rules, laws, and permit requirements.

Performance measures allow 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. The two primary categories are 1) *Plan Performance*, evaluated and measured by the RWMG (i.e., progress toward accomplishing goals and objectives); and 2) *Project Performance*, the monitoring and evaluation of individual projects against their respective performance measures and outcomes, conducted by project sponsors and reported to the RWMG. The objectives of the Plan (Chapter 5 *Goals and Objectives*) generally represent the intended benefits of Plan implementation, and include both Plan-level and project-level benefits (Chapter 10 *Impacts and Benefits*). Evaluation of Plan Performance will include an assessment of the extent to which Plan-level benefits have been realized through Plan implementation. Assessment of Project-level benefits will be incorporated into individual project monitoring plans.

The Upper Feather River (UFR) RWMG is committed to an IRWM Program with a planning horizon that goes well beyond the recommended 20 years. The Memorandum of Understanding (MOU) brings together entities that intend to collaboratively address the long-term water resources management needs of the UFR Region. The Plan will undergo periodic updates and revisions to reflect changing conditions in the Upper Feather River Region and any updated IRWM Guidelines. In addition, the RWMG membership and governance processes may evolve in response to changing conditions.

In addition to this IRWM's extended implementation horizon and the possibility of changing governance processes in the RWMG, the list of implementation projects will require updating as the IRWM planning effort proceeds and projects are both completed and new ones identified. For these reasons, monitoring Plan performance will be closely tied to the implementation of individual projects, and the IRWM Plan focuses on establishing a framework for evaluation that will link project completion to IRWM Plan implementation.

11.2 Plan Performance and Monitoring

Plan Performance describes the overall performance of the Plan in meeting its goals and objectives, both through implementation of individual projects and through the governance and operation of the Plan itself. Evaluating Plan Performance will focus on summarizing and integrating project-level assessments but will also involve the effectiveness of the Plan itself, as not all of the intended benefits of the Plan accrue through the implementation of individual projects.

11.2.1 Process for Plan Evaluation

11.2.1.1 Responsibility for IRWM Plan Implementation Evaluation

The RWMG will appoint a representative who will be responsible for evaluating and reporting on Plan Performance, including Plan implementation, progress toward meeting Plan objectives, Plan-level benefits, and implementation and outcomes of individual projects approved under the Plan. This representative may be a member of a participating agency or an outside party.

11.2.1.2 Evaluation Frequency

Plan Performance will be evaluated annually in a report to the RWMG by the appointed representative. Evaluation of Plan Performance will also accompany each successive IRWM implementation grant solicitation; release of updated IRWM Guidelines by DWR; update to regulations; or emergence of new data, science, or awareness of changed regional conditions that affect the issues and priorities within the Region. In response to any or all of the above, the RWMG will review the Plan's content and, as needed, will update the water management issues, goals, objectives, and strategies in the Plan area. Such updates to the Plan will be through an amendment process (Chapter 2 *Governance, Stakeholder Involvement, Coordination)*. Major changes to the Plan, including formal update and re-adoption requiring the approval of the RWMG, will occur only as required by the State of California or as deemed necessary by the RWMG. It is the intent of the RWMG that if adequate funding is available, the Plan will be formally reviewed, revised, and re-adopted no less frequently than every five years.

11.2.1.3 Feedback Protocol

After acceptance by the RWMG, the annual report on Plan Performance will be made available to the public on the RWMG website (http://www.featherriver.org), in print at appropriate locations in the Plan area (e.g., offices of participating agencies, libraries, community centers, etc.), or upon request. The annual report will provide the basis for discussion of how findings or "lessons learned" from Plan-level evaluation and project-specific monitoring efforts will be used to improve the RWMG's ability to implement future projects in the IRWM Plan. In addition, data from individual project monitoring and data collected for Plan-level assessment will be publicly available (Section 11.4).

If the annual report identifies a significant deficiency in Plan Performance, the RWMG may elect to hold public meetings or seek public comment on how implementation of the Plan, or the Plan itself, should be amended to better address regional issues. Amendments may include administrative changes, changes to the resource management strategies (RMS) (Chapter 6 *Resource Management Strategies)*, or changes to the goals and objectives of the Plan itself. For example, after a review of the RWMG performance measures, the RWMG may need to amend the RMS or the actual IRWM objectives to account for new scientific data or regional changes in conditions that could alter baseline assumptions or understanding of water management issues discussed in the IRWM Plan. Deficiencies in the performance of an individual project will be addressed by the required remedial and/or adaptive management components of the project-specific monitoring plan; however, the RWMG will take into account "lessons learned" from individual projects when considering future project proposals.

11.2.1.4 Project Updates, Additions, and Funding

With each IRWM grant solicitation, the RWMG will review the implementation project list and will invite project proponents to participate in the grant opportunity. Project proponents will be responsible for developing individual applications in response to solicitations. Updating the implementation project list within the Plan will be necessary as projects are funded and implemented, regardless of the source of funding. The RWMG's appointee or representative will update the project implementation list for review at the quarterly RWMG meeting.

The RWMG will issue a "call for projects" annually, or as warranted by upcoming grant solicitations, providing opportunity for the consideration of new projects to add to the implementation project list. The RWMG will review projects in accordance with the process presented in Chapter 9 *Project Development*, and the list will be updated annually.

11.2.1.5 Comparison to the 2005 IRWM Plan

The 2005 Upper Feather River IRWM Plan placed adaptive management at the core of its Technical Analysis and Plan Performance. Adaptive management methods were included in the 2005 Plan as Objective 12, and were divided into passive and active strategies. Passive adaptive management was described as model-based predictions of how ecosystems would respond to certain management actions, and was conducted without experimental design elements such as replication, randomization, or controls.

The 2005 Plan described active adaptive management as a process of applying management strategies as treatments in a controlled, replicated experiment that would allow managers to isolate the effects of management treatments. Furthermore, active adaptive management would allow direct comparison of different management strategies to better inform future management actions.

The 2005 Plan focused on implementation of projects funded by existing sources such as Monterey Settlement Agreement funds and CALFED, and administered through existing programs such as the Feather River Coordinated Resource Management, Plumas Watershed Forum, and the Quincy Library Group. Additionally, the Region successfully obtained $7 million in Proposition 50 grant funds for implementation projects identified in the 2005 IRWM Plan. However, the 2005 Plan did not include a process for evaluating the performance of the Plan itself, and project performance evaluation was expected to consist of active adaptive management strategies.

11.2.2 Plan Performance Measures

Plan Performance will be evaluated in terms of the Plan-level benefits (Chapter 10 *Impacts and Benefits*), the Plan objectives (Chapter 5 *Goals and Objectives*), and additional measures described in this section. Each project approved under the Plan will address at least one of the Plan objectives. Plan Performance in terms of those objectives will depend largely on the success of individual projects. Table 11-1 presents the 5 Plan-level benefits, 18 Plan objectives, and 5 additional measures by which Plan Performance will be assessed along with suggested metrics to quantify success.

Table 11-1. Plan Performance Measures and Metrics

PERFORMANCE MEASURE	METRICS
Plan-level Benefits	
Fostering understanding and information sharing within the Region	Conduct RWMG public meetings Update Featherriver.org website Data Management Standard Determine qualitative perceptions of participating stakeholders
Opportunities to collaborate on project development and solving regional issues	Coordinate with stakeholder agencies (including staff) Involve the public in project selection Involve DACs and Tribal representatives
Identification of diverse funding sources	Track the number and diversity of successful grant applications Assemble and disseminate lists of grant opportunities targeted to various stakeholder groups
Capacity building	Coordinate with stakeholder agencies, including staff (organizational capacity-building trainings) Contact UC Davis Extension –Agriculture, NRCS, and other programs to provide funding and assistance to private land owners Improve efficiency and reduce redundancy
Venue to address policy-related and regulatory processes	Conduct RWMG public meetings Update Featherriver.org website Evaluate Plan Performance annually
Plan Objectives[1]	
Restore natural hydrologic functions	Implement 3 Plan projects that restore natural hydrologic functions Update the project list and technical and scientific studies at the annual RWMG meeting
Reduce potential for catastrophic wildland fires in the Region	Implement 3 Plan projects that reduce catastrophic wildfire potential Update the project list and technical/scientific studies at the annual RWMG meeting

[1] The Plan objectives were approved on March 27, 2015 at a regular RWMG meeting. The objectives listed in this table are verbatim.

PERFORMANCE MEASURE	METRICS
Balance the needs of forest health, habitat preservation, fuels reduction, forest fire prevention, and economic activity in the Region	Continue to support the integration of biomass electrical generation biofuels development with 1) forest and habitat conservation in US Forest Service (USFS) plan updates, 2) in the carbon sequestration and conservation plan for forests (CA Air Resources Board [ARB]), and 3) by implementing projects UF-12 and TAC-6
Build communication and collaboration among water resources stakeholders in the Region	Continue MOU development with water and land management entities in the Region Develop a process for supporting and endorsing collaborative projects, studies, and actions sponsored by MOU signatories Develop a review process for monitoring information and needs Develop a process for updates on conflicts identified in the Plan during public meetings, on the featherriver.org website, and through Inter-agency coordination/consultation
Work with DWR to develop strategies and actions for the management, operation, and control of State Water Project (SWP) facilities in the watershed in order to increase water supply and recreational and environmental benefits to the Region	Review proposals and management planning for lands, habitat, and cultural/historical resources within and downstream from SWP facilities in the watershed May develop an informational item that updates inter-agency and inter-regional planning efforts at a specific RWMG meeting every year
Encourage municipal service providers to participate in regional water management actions that improve water supply and water quality	Get involved in inter-agency, intra-regional planning efforts Participate in project selection Develop project-specific criteria
Continue to actively engage in Federal Energy Regulatory Commission (FERC) relicensing of hydroelectric facilities in the Region	Obtain an annual progress report from FERC regarding its implementation of hydroelectric license conditions as scheduled for FERC No. 2100, 2107, 699, 2105 Obtain a 'letter of intent' from FERC on fish and amphibian passage improvements, wildfire recovery projects, the James Lee and Indian Jim visitors and outdoor recreation and education and events center, the Rock Creek Bench river access project, and the accidental spill response plans. These are implementation priorities for water stakeholders in the North Fork Feather River Canyon

PERFORMANCE MEASURE	METRICS
Address economic challenges of municipal service providers to serve customers	Determine Plan-level efforts of participating entities Obtain outside funding Review efforts by regional and local planning agencies
Protect, restore, and enhance the quality of surface and groundwater resources for all beneficial uses, consistent with the Basin Plan	Implement 2-3 Plan projects that address surface and groundwater resource conservation and quality
Address water resources and wastewater needs of Disadvantaged Communities (DACs) and Native Americans	Implement 4 Tribal benefit and 17 DAC benefit Plan projects Update the DAC water needs inventory every five years, or as needed by the RWMG
Coordinate management of recharge areas and protect groundwater resources	Implement 3 Plan projects that include recharge area and groundwater conservation efforts Assess whether inter-agency, intra-regional planning efforts include implementation of the region-wide LIDAR project (UF-13)
Improve coordination of land use and water resources planning	Incorporate the UFR IRWM Plan into updates of land, water, and natural resource planning for the three national forests in the Region Submit the UFR IRWM Plan as a planning reference for the Plumas, Lassen, and Tahoe National Forest Land and Resource Management Plan updates Support efforts by regional and local entities to participate in ARB's carbon sequestration and conservation plan for forest and agricultural landscapes Integrate TEK into USFS, ARB, and State Water Resources Control Board (SWRCB) plans Provide resource management strategy recommendations developed by the IRWM Plan workgroups for the next update of the California Water Plan
Maximize agricultural, environmental and municipal water use efficiency	Implement 2-3 Plan projects that address water use efficiencies
Effectively address climate change adaptation and/or mitigation in water resources management	Implement 3-4 Plan projects that address GHG reductions, and climate adaptation and mitigation in water and watershed management Update the project list and technical and scientific studies at the annual RWMG meeting

PERFORMANCE MEASURE	METRICS
Improve efficiency and reliability of water supply and other water-related infrastructure	Implement 2-3 Plan projects that address water use efficiencies
Enhance public awareness and understanding of water management issues and needs	Implement 4 Plan projects that enhance public awareness and public education about water issues and needs Update the project list and technical and scientific studies at the annual RWMG meeting Support MOU signatory proposals for public outreach/education, public workshops and meetings, and water and watershed education in school programs
Address economic challenges of agricultural producers	Encourage agricultural producers to participate in potential funding opportunities through IRWM and other sources Obtain outside funding
Work with counties/communities/groups to make sure staff capacity exists for actual administration and implementation of grant funding	Implement 2 to 3 Plan projects that include capacity building for project development, implementation, and evaluation Update the project list and technical/ scientific studies at the annual RWMG meeting
Additional Measures	
How robust the IRWM Plan process has been after Plan development	List the number of RWMG meetings held vs. identified benchmarks ♦ Quarterly RWMG meetings ♦ RWMG meetings will be cohosted with member organizations when appropriate
Public outreach and engagement	List the number and variety of attendees compared to what was targeted by the RWMG
Economic benefits	Develop a process for quantifying and assessing the amount of funding and local job creation associated with the implementation of projects identified in the Plan Retain and grow water management and watershed stewardship job opportunities Develop volunteer water management positions on regional boards and commissions for community health, education, and improvement activities, including school programs
Reduction of conflicts identified in the Plan	Develop a process for evaluating improved collaboration that includes responding to stakeholder participants and their qualitative perceptions

PERFORMANCE MEASURE	METRICS
Overall effectiveness of the planning process	List the number of funded and implemented Plan projects List the number of DAC needs and projects that have advanced to implementation readiness List the number of tribal partnership projects funded and implemented Develop administrative capacity for the RWMG and for MOU signatories and project partners List the number of RMS recommendations that are incorporated into the next California Water Plan update
Up-to-date understanding of climate change vulnerability	Review the most current climate change projections, every five years Review actions to address priority climate change vulnerabilities, annually Re-prioritize climate change vulnerabilities, every three years

Many Plan performance measures will be assessed using metrics defined for individual projects (project-specific criteria) that cannot be defined at the Plan level; Section 11.3 includes a general framework for project-level monitoring. Other measures can be assessed in terms of the number and variety of projects approved under the Plan (project selection). Finally, some measures can be quantified directly, such as local and regional planning agency efforts, number of public outreach programs, tracking attendance and participation in public meetings, public opinion surveys, cooperation and workload sharing among agencies, and the amount of grant funding obtained. The annual report to the RWMG on Plan Performance will summarize progress made in the preceding year in terms of each of the 28 measures in Table 11-1.

11.3 Project Performance and Monitoring

The UFR RWMG or its appointee will be the primary contact for project proponents in the Plan area. Each project approved under the Plan will contribute to the accomplishment of at least one Plan objective, and it is through the implementation of approved projects that the Plan will provide many of its intended benefits. Therefore, evaluation of Project Performance is essential to assessing the overall success of Plan implementation. Project Performance will be quantified and assessed through the implementation of a Project-specific Monitoring Plan (PSMP).

11.3.1 Project-Specific Monitoring Plans

During the development of actual grant applications, PSMPs will be prepared and implemented for most of the projects in this IRWM Plan. This section provides a framework for formulating PSMPs; however, individual PSMPs will vary depending on the nature of the project, the amount of stakeholder involvement, and the type(s) of affected resources. The minimum PSMP requirements set forth in this chapter are intended only to satisfy the monitoring and reporting requirements of this IRWM Plan, and although they may suffice for other monitoring and reporting requirements (e.g., regulatory agencies, NEPA/CEQA, etc.), other similar monitoring plans may be required concurrently with the PSMP. Each grant solicitation will have its own PSMP content requirements. The minimum content, discussed in the following sections, is consistent with content in the Proposition 84 and Proposition 1 guidelines. Under no circumstances will the PSMP supersede or void a condition required by any other plan as part of project approval.

11.3.1.1 Projects Requiring a PSMP

Projects selected for grant solicitations under the IRWM Plan will require a PSMP as part of the application submittal. Proposed implementation projects promote one or more Plan objectives. Such projects include, but are not limited to, infrastructure construction/improvement, restoration, surface or groundwater monitoring, and forest fuels reduction. The RWMG may require PSMPs for projects such as utility rate tiering, metering, land use changes, and system reoperation in order to track the success of such projects at promoting Plan objectives.

Projects such as education and outreach programs that secure outside funding, capacity-building activities, administrative actions by the RWMG and its appointed representatives, data-gathering, RWMG outreach activities, meetings, and inter-agency coordination are not considered projects and will not require a PSMP; these activities will be tracked as part of the annual Plan Performance assessment.

11.3.1.2 Party with Primary Responsibility for the PSMP

The project proponent is responsible for development of a PSMP for each project, according to the procedures described in this chapter. The project proponent is responsible for ensuring that the PSMP meets the minimum requirements specified in this chapter and any additional requirements specified by the RWMG or other agencies.

The project proponent is also responsible for guaranteeing the implementation of the PSMP for the life of the project or the term of the monitoring program, as specified in the PSMP. The exact mechanism for implementation of the PSMP will vary by project; however, the following position regarding monitoring of projects is the adopted policy of the UFR RWMG:

> *RWMG Policy (adopted 6/15/2015): Although project monitoring requirements will vary by grant solicitation, it is the position of the Upper Feather River Regional Water Management Group that project monitoring for IRWM-sanctioned projects should be objective, transparent, available to the public, required to be conducted by a third party, and science-based.*

To implement this policy, each PSMP will include a statement that monitoring will be conducted by a third party, subject to approval of the RWMG.

11.3.1.3 Review of the PSMP

The RWMG or its appointed representative will review and accept a PSMP before the project itself is submitted for IRWM funding. Funding agencies and other entities with regulatory authority over the project may also review the PSMP and require revisions to it as a condition of a grant or permit. This Plan does not require public review of PSMPs; however, it is advisable for most projects.

When Plan projects are submitted to other funding sources, they are not subject to the requirements of this Plan. However, project proponents are encouraged to submit their final PSMPs to be included on the Plan website to assist in building a regional data repository.

11.3.1.4 Timing of the PSMP

The project proponent will prepare a complete draft PSMP and submit it to the RWMG, or an appointed representative, for approval. The project proponent will complete a final PSMP and will submit it to the RWMG before the final project is approved for grant consideration. The PSMP will be included in all funding or permit applications (if submitted) to outside agencies, and may be subject to revision in response to requirements of outside agencies with jurisdiction over the proposed project.

11.3.1.5 Minimum Required Contents of the PSMP

Project-specific monitoring must include not only the physical elements of the project (*outputs* such as tank replaced, restored wetland, etc.) but also what the project accomplished in terms of Plan goals and objectives (*outcomes* such as a water supply improved for a DAC for the life of the project, improved watershed retention or sediment control). In other words, monitoring must address not only what the project achieved but also what it contributed toward the achievement of Plan goals and objectives.

Monitoring plans will be prepared according to the specifications required by a funding source. The DWR provides guidance for the contents of a PSMP; this guidance forms the minimum standard for PSMPs in the UFR IRWM Plan. At a minimum, a PSMP must include the following:

- Describe clearly and concisely (in a table format) 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). Express monitoring in quantitative metrics to the greatest degree possible.
- Measures to remedy or react to problems encountered during monitoring. An example would be to coordinate with the Department of Fish and Wildlife if a species or its habitat is adversely impacted during construction or after implementation of a project.
- Location of monitoring.
- Monitoring frequency.
- Monitoring protocols/methods, including who will perform the monitoring.
- A statement that monitoring will be conducted by a third party, subject to approval of the RWMG.
- A data management system or procedures to keep track of the results of monitoring. Each PSMP must address how the collected data will be or can be incorporated into statewide databases. Note that standards and guidance relating to the integration of data into statewide databases is included in Section 11-4.
- Procedures to ensure the monitoring schedule is maintained, and that adequate resources (funding) are available to maintain project monitoring throughout the scheduled monitoring timeframe.
- Reporting procedures that include a written report provided to the RWMG annually. Any exception to annual reporting must be thoroughly justified in the PSMP.

As stated previously, it is the position of the UFR RWMG that all monitoring should be conducted by a third party, all monitoring should be science-based, and all monitoring results should be available to the public.

11.3.1.6 Oversight of the PSMP

The project proponent will be responsible for ensuring that the PSMP is implemented entirely, and that funding is available for adequate implementation for the life of the monitoring program. The RWMG or its appointed representative will conduct oversight of each Plan-approved project to confirm that the PSMP has been implemented. Oversight will include confirming adherence to all reporting and data submission requirements. Funding for this oversight may be required from the project proponent as part of the proposed project.

11.4 Data Management Standard

The intent of the Data Management Standard (DMS) is to ensure efficient use and access to available water resources, land management, and environmental monitoring data for the UFR Region, and to ensure that data generated by IRWM implementation activities can be integrated into existing state databases. During the development of the UFR IRWM Plan update, a website (http://featherriver.org) has functioned as the region's DMS and it will continue in perpetuity. The website will be maintained by an entity appointed by the RWMG.

No data utilized in the preparation of a project proposal or collected for any project approved under this Plan will be considered the private property or possession of the project proponent or other private entity except data subject to assertions of Tribal sovereignty. No data collected as part of project implementation may be withheld as proprietary except data that are the possession of a sovereign Tribal entity. Free, open-access to data, along with data collection and submission standards outlined in this section, will promote the IRWM Plan objective of making regional data available to all stakeholders in the Plan area and will support the RWMG's goal of transparency.

11.4.1 Data Needs and Typical Data Collection Techniques

Implementation projects included in the Plan range from school watershed educational programs to groundwater monitoring programs, to construction projects, to incorporation of Traditional Ecological Knowledge (TEK) in regional projects. The data developed for each project and produced during the operations phase of each project will be very different. For construction projects, typical data include geotechnical studies and topographic surveys. Groundwater monitoring programs usually generate well boring logs during construction and generate groundwater level and water quality data during the monitoring or operations phases. In its PSMP, each project will be required to identify the data that will be required and generated by the project; the data will be uploaded to the Plan website and state databases.

The Uplands and Forests Workgroup identified a lack of transparent, publicly available, and science-based monitoring data as a general issue in the Region (Chapter 4 *Regional Water Issues*). That data need is contained in the RWMG policy on monitoring (Section 11.3.1.2).

Other regional data needs identified by Workgroups during IRWM Plan development are expressed as resource management strategy recommendations, and include:

- Sources of real-time data such as:
  - Local meteorological/weather
  - Soil moisture
  - Water application/use monitoring
  - Surface water depth and flow
  - Surface to groundwater depth
  - Groundwater modeling (Table 6-1: RMS 1; Agricultural Lands Stewardship; Strategy 5);

- Improved data on baseline hydrology and capacity of existing water management components (Table 6-1: RMS 1; Agricultural Lands Stewardship; Strategy 5);
- Data regarding the environmental and health effects of precipitation enhancement projects (Table 6-1: RMS 10; Floodplains, Meadows, Waterbodies; Strategy 1);
- Publicly accessible groundwater monitoring data including:
    - Hydrogeologic characterization of the aquifers
    - Changes in groundwater levels
    - Groundwater flow (interbasin + to/from streams)
    - Groundwater quality
    - Land subsidence, if any
    - Surface water flow
    - Surface water quality
    - Interaction of surface and groundwater (Table 6-1: RMS 8; Agricultural Lands Stewardship; Strategy 2);
- Improved data on sources of pollution including marinas and abandoned mine sites (Table 6-1: RMS 17; Floodplains, Meadows, Waterbodies);
- Inventory of the organic content of soil (Table 6-1: RMS 20; Agricultural Lands Stewardship; Strategy 5);
- Additional stream gages, precipitation stations, water quality monitoring stations, and groundwater monitoring wells (Table 6-1: RMS 22; Uplands and Forests; Strategy 3);
- Groundwater basin management plans for all 14 groundwater basins in the Plan area (Table 6-1: RMS 24; Floodplains, Meadows, Waterbodies; Strategy 2);
- Improved tracking and reporting method to document changes in the watershed (Table 6-1: RMS 26; Floodplains, Meadows, Waterbodies; Strategy 1 and 2);
- Improved data and tracking on hydrograph and precipitation in the watershed (Table 6-1: RMS 26; Uplands and Forests; Strategy 1);
- Improved tracking and reporting methods using Traditional Ecological Knowledge (Table 6-1: RMS 26; Uplands and Forests/Tribal Advisory Committee; Strategy 1), and;
- Improved understanding of climate change and associated impacts including:
    - Climatic effects on catastrophic wildfire
    - Climatic effects on flooding
    - Increased understanding of snowpack
    - Regional greenhouse gas (GHG) emissions inventory and forecasts
    - Updated, downscaled, and best available climate change projections.

Monitoring data, collected for individual projects, will vary depending on the nature and purpose of the project, and each PSMP will specify the type of data collected. In general, Project Performance is expected to be quantifiable; PSMPs will minimize qualitative or descriptive data collection. Photo-documentation will be the preferred method for qualitative monitoring, and data submissions to the website may include photographs. While the UFR website is configured to allow users to attach photos or other digital files when they submit data, other websites such as Flickr or Google+ provide free, geo-located photo galleries. Monitoring photos submitted to these public sites are likely to reach a broader audience and be easier to access, update, or manage than a custom photo gallery tool built especially for the UFR website. Photos posted to online photo websites may share links to their project photos in relevant pages on the UFR website.

Data submitted to the UFR website will be in a format compatible with import into standard analytical platforms (Excel, .xlsx, or comma-separated value, .csv). Scanned or digitized field data forms will not satisfy the requirements for data submission to most project funders. Wherever applicable, geospatial information should accompany any submitted data. Preferred formats for point locations are latitude/longitude using the WGS 1984 datum. GIS layers should be in the UTM Zone 10 NAD 83 projection, or include a projection file (.prj).

11.4.2 Data Submission to the Website

Monitoring entities and Plan participants may post data directly onto the UFR website. Registration to use the site is free and open to all who request an account. RWMG designees may administer the website to remedy errors, delete fake accounts, or request clarification if questions arise about any submitted data.

Data may be submitted to the website using forms that request basic metadata such as author, title, contact information, date, and keywords. These forms were developed using national standards for spatial metadata developed by the Federal Geographic Data Committee. Contributors should also provide a list of outside databases to which the data have also been submitted, as well as digital copies of any forms or reports generated by statewide databases confirming their receipt of data submissions.

11.4.3 Stakeholder Access to Data

It is the intent of the RWMG to ensure that all public data generated by the projects are available to the stakeholders and project proponents. However, it is not the intent of the RWMG to duplicate efforts and data that are available elsewhere. To accomplish these two goals, the RWMG will ensure that all stakeholders will have access to the data generated by the other projects through the proposed projects page (http://featherriver.org/proposed-projects). The proposed-projects page contains links to the project-specific webpages, if applicable, and will contain links to state database webpages.

The UFR website (www.featherriver.org) is free and accessible to the public. When users share data to the site they may designate it as "sensitive" or "not for public distribution." Examples of sensitive data may include the location of cultural resources or sensitive species. The UFR website has no special security features; it is recommended that users concerned with unauthorized use of their data *not* submit it to the UFR website. Rather, they should submit an entry that describes their data, and provide contact information so interested parties may follow up.

11.4.4 Data Quality Control

Monitoring entities, participating agencies, and all parties submitting data to the website are expected to take primary responsibility for the integrity of the data they submit and to ensure that those data are consistent with the standards of the project funder. Parties submitting data to the website are exclusively responsible for the accuracy and truthfulness of the data they submit. The RWMG makes no warrantee regarding accuracy or integrity of data on the website.

Funding for a detailed review of data submitted to the website is currently not available. However, should administrative funding become available, the website managing entity will perform an annual audit of data that will include quality control of all data submitted to the website.

The website has a public comment system that allows people to email the website managing entity regarding concerns about the data. The website managing entity will consult with data submitters and stakeholders to address stakeholder concerns regarding data posted to the website/DMS.

11.4.5 Integrating Data into State Databases

Project design will include an evaluation of the data protocols for statewide databases to which project data will be submitted (Section 11.4.2). The legislation supporting a given grant program may specify a state database for data submittal. These protocols will inform the design of the project-specific data collection protocol. If project data will not fit into a particular state database, project designers will use the best principles approach, along with discussions with the project technical advisory committee, to ensure that effective, efficient, and defensible methods are employed.

A brief overview of public databases follows, categorized by data type. This list is not exhaustive but includes all databases described in DWR's IRWM Guidelines (both Proposition 84 and Proposition 1). The last category (Section 11.4.5.5) includes searchable databases that do not accept direct data entry; however, they represent significant data sources that can be useful when designing the data component of a project or assessment.

11.4.5.1 General Databases

Sacramento River Watershed Information Module – SWIM is a data tool developed by the Sacramento River Watershed Program to catalog technical information about the Sacramento River watershed. This site is a clearinghouse and is not intended to provide a protocol for data collection. The Upper Pit IRWM Region used SWIM as its data management system. The UFR website includes imported data from SWIM relating to the UFR Region. Information on SWIM is available at www.sacriver.org.

California Environmental Data Exchange Network – CEDEN is a system designed to facilitate integration and sharing of data collected by many different participants and is organized into regional data centers. The UFR IRWM Plan area is covered by the Central Valley Regional Data Center. CEDEN data templates, prepared by the regional data centers, are available on the CEDEN website, http://www.ceden.org.

11.4.5.2 Water Quality Databases

Surface Water Ambient Monitoring Program – Any group collecting or monitoring surface water quality data using funds from Propositions 13, 40, 50, and 84 must provide such data to SWAMP. The SWRCB has developed required standards for all data submissions. The SWAMP data checker produces a summary report for each data submission. Information on SWAMP is available at http://www.swrcb.ca.gov/water_issues/programs/swamp/index.shtml.

11.4.5.3 Groundwater Databases

Groundwater Ambient Monitoring and Assessment program – GAMA provides a comprehensive assessment of water quality in water wells throughout California. Projects that include a groundwater component should contact the GAMA program manager before designing a field or lab data output format. GAMA requires electronic submittal of information and prefers GeoTracker (http://www.waterboards.ca.gov/ust/electronic_submittal/); Excel files can be problematic. Additional information on the GAMA program is available at http://www.waterboards.ca.gov/gama/.

California Statewide Groundwater Elevation Monitoring Program – The intent of the CASGEM program is to establish a permanent, locally managed program of regular and systematic monitoring in all of California's alluvial groundwater basins. CASGEM anticipates that the monitoring of groundwater elevations required by the enacted legislation will be done by local entities. The purpose of the CASGEM database is to maintain the collected elevation data in a readily and widely available public database. Local entities such as counties or agencies implementing an IRWM Plan that do not agree to conduct groundwater monitoring are ineligible to receive water grants and loans from the state. Information on the CASGEM Program is available at http://www.water.ca.gov/groundwater/casgem/

11.4.5.4 Climate Change Database

Cal-Adapt – The California Energy Commission (CEC), the California Natural Resources Agency (CNRA), and the Public Interest Energy Research Program (PIER) maintain Cal-Adapt, an online database that synthesizes and shares the most up-to-date understanding of how climate change might impact the State of California. Projected impacts of precipitation changes, temperature increases, and wildfire in the UFR IRWM Plan are available through the year 2100. Cal-Adapt is available at http://cal-adapt.org/

11.4.5.5 Reference-only Databases

Water Data Library – DWR maintains the state's WDL which stores data from various monitoring stations, including groundwater monitoring wells, water quality stations, surface water stage and flow sites, rainfall/climate observers, and well logs. Information regarding the WDL is available at http://wdl.water.ca.gov/.

Integrated Water Resources Information System – DWR maintains IWRIS, a data management tool for water resources data that is not a database. IWRIS is a web-based GIS application that allows entities to access, integrate, query, and visualize multiple sets of data simultaneously. Information on IWRIS is available at http://www.water.ca.gov/iwris/.

California Irrigation Management Information System – CIMIS is a program in the Office of Water Use Efficiency Branch (DWR) that manages a network of automated weather stations in California. The purpose of CIMIS is to make real-time weather data publicly available for irrigation scheduling. CIMIS information is available at http://www.cimis.water.ca.gov/cimis/.

California Natural Diversity Database – CNDDB is maintained by the Biogeographic Data Branch of the California Department of Fish and Wildlife. The purpose of CNDDB is to inventory the status and location of rare plants and animals in California. CNDDB staff work with partners to maintain current lists of rare species and to maintain a database of GIS-mapped locations for these species. Plan projects involving surveys for wildlife, such as habitat restoration projects, should report records of sensitive species to CNDDB. Information on accessing and submitting data to CNDDB is available at http://www.dfg.ca.gov/biogeodata/cnddb/.

CHAPTER 12.0 FINANCE

12.1 Introduction

Under California Department of Water Resources Propositions 84 and 1, Integrated Regional Water Management (IRWM) Grant Program Guidelines require that regional water management groups (RWMG) address their strategy for financing an IRWM Plan and implementation projects and programs, as follows:

- List known and possible funding sources, programs, and grant opportunities for the development and ongoing funding of the IRWM Plan.
- List the funding mechanisms, including water enterprise funds, rate structures, and private financing options, for projects that implement the IRWM Plan.
- Provide an explanation of the certainty and longevity of known or potential funding for the IRWM Plan and projects that implement the Plan.
- Provide an explanation of how operation and maintenance (O&M) costs for projects that implement the IRWM Plan would be covered and the certainty of operation and maintenance funding.

The purpose of the "Finance Standard" is to ensure that the RWMG has considered IRWM Plan financing at a programmatic (general) level and that a snapshot of financing is documented for stakeholders. It is not the intent of the finance standard to document that all funding has been fully secured. Most of the cost of developing, maintaining, and implementing an IRWM Plan should be borne by local entities, with state grant funding providing a necessary, but relatively small, supplement in funds. Documentation of the various funding sources will be needed so that the RWMG and its stakeholders understand how the funding pieces fit together and how the IRWM plan will be formulated, maintained, and implemented.

12.1.1 Funding History

The original IRWM Plan for the Upper Feather River (UFR) watershed was adopted in 2005. The 2005 Plan was funded by and prepared in accordance with IRWM guidelines established under Proposition 50--The Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002. The Feather River Watershed Authority, responsible for the creation of the 2005 Plan, consisted of four partner agencies: Plumas County, Plumas National Forest, Sierra Valley Groundwater Management District, and Plumas County Flood Control and Water Conservation District.

The 2005 Plan focused on implementation of projects funded by existing sources such as Monterey Settlement Agreement funds and CALFED, and administered through existing programs such as the Feather River Coordinated Resource Management, Plumas Watershed Forum, and the Quincy Library Group.

In 2007, the Upper Feather River IRWM program was awarded $7 million in Proposition 50 grant funds for implementation projects identified in the 2005 Plan. The grant award funded an original seven projects related to water quality and watershed restoration. In 2014, DWR approved the reprogramming of approximately $2,200,000 of the funds for three additional water supply and wastewater system improvements, conservation, and restoration projects. Table 12-1 summarizes the nine final projects funded by the grant award.

Table 12-1 UFR Proposition 50-Funded Implementation Projects

Project Name	Project Sponsor	Grant Amount
Upper Middle Fork Project	County of Plumas; UC Davis; Sierra Valley Groundwater Management District	$1,400,000
Quincy Wetlands Treatment Project	Plumas Corporation; Quincy Community Services District	$408,544
National Forest Water Quality Improvement Project	USDA/Forest Service-Plumas National Forest	$1,927,848
Genesee Valley Integrated Water Management Project	Feather River Land Trust	$555,548
Sierra Valley Well Assessment and Basin Management Plan	County of Plumas; Sierra Valley Groundwater Management District	$123,679
Sierra Valley Integrated Water Project	Feather River Land Trust	$67,358
Chester River Parkway Project*	Feather River Land Trust	$400,000
Greenville Water and Sewer System Repairs Project*	Indian Valley Community Services District	$1,290,000
Taylorsville Wastewater Improvement Project*	Indian Valley Community Services District	$184,080
* Indicates the project utilizes reprogrammed Proposition 50 funds.		

After the passage of Proposition 84/1E--The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006–the UFR was required to apply for "IRWM Region status and update its IRWM Plan to maintain its eligibility for further grant funding through DWR's IRWM Program. In 2009, the Upper Feather River watershed applied for IRWM Region status through DWR's Regional Acceptance Process (RAP) and was approved. The RAP is a component of the IRWM Program guidelines and is used to evaluate and accept an IRWM Region into the IRWM grant program. The RAP is not a grant funding application; however, acceptance of the composition of an IRWM Region into the IRWM grant program is required for IRWM grant funding eligibility.

The 2016 IRWM Plan Update was funded by a Proposition 84 IRWM (Round 2) Planning Grant in 2012. Grant match funding was provided through watershed planning work conducted by Plumas County Flood Control and Water Conservation District between 2008 and 2012.

In 2014, California voters approved Proposition 1 Water Bond, which enacted the Water Quality, Supply, and Infrastructure Act of 2014. With this new proposition, IRWM Regions are required to amend their IRWM plans to meet updated standards. The change in standards occurred in the latter part of the 2016 UFR Region's Plan update process; however, the DWR approved the RWMG's request to address both standards for efficiency and to insure funding eligibility. The 2016 UFR Plan is consistent with both Proposition 84 and 1 IRWM grant program guidelines, making the RWMG eligible for future IRWM funding opportunities.

12.2 Program-Level Funding Sources

Implementation of the IRWM Plan relies upon RWMG members and stakeholders to provide in-kind support, financial support, and to obtain other revenue sources for the anticipated costs of plan implementation and ongoing activities of the RWMG. There is often substantial uncertainty when relying primarily on grant funding; therefore, it is prudent to look for other forms of consistent, secure, and long-term funding to sustain IRWM planning efforts. In addition to assisting project proponents in the implementation of projects that support the Plan, the RWMG is responsible for other important tasks and functions in the UFR IRWM Region. The scope of the RWMG is detailed in Chapter 2 *Governance, Stakeholder Involvement, and Coordination*.

The RWMG has been instrumental in facilitating the Region al collaboration and integration of watershed planning efforts intended by the Regional Water Management Planning Act (SB 1672). Ongoing activities by the RWMG include providing Region al capacity building, education and training, economic development, identification and promotion of issues of Region al interest and consensus, and engagement with downstream water users and adjacent IRWM Region s. RWMG activities that are important to maintain regional collaboration include:

- Tracking federal and state mandates; sharing information with RWMG members and stakeholders through email and/or web postings.
- Identifying and applying for funding opportunities to continue Plan implementation and to help participating entities to respond to regulatory mandates.
- Providing centralized data management services.
- Facilitating discussion of controversial and/or complicated IRWM issues and reaching consensus when possible.
- Providing representation in response to policies and mandates affecting the Region.

The Plumas County Flood Control and Water Conservation District assumed the lead role in the IRWM planning process as the DWR Proposition 84 Grantee, and provides staff support and a venue for RWMG meetings. In addition, the Proposition 84 IRWM Planning Grant provided financial support to the RWMG and the Project Team during the planning process. Upon adoption of the Updated 2016 IRWM Plan, the RWMG will become responsible for ensuring the perpetuity of the RWMG organization and the IRWM Plan.

The success of the RWMG in addressing the ongoing needs of the Region depends on the human and financial resources available for ongoing activities. RWMG members and stakeholders can provide a full range of RWMG staffing options including 100 percent in-kind support to full-time RWMG staff (executive director, administrative staff, and programmatic staff implementing projects and policy development throughout the Region) and a RWMG office. Additional financial resources are essential for a variety of Plan Implementation activities. To support these activities, possible funding sources are identified below:

In-Kind Support

Stakeholders that are not able to contribute financial resources may be able to make other essential contributions. Providing in-kind support could include staff time for meeting organization and facilitation, map-making, grant writing and administration, preparing newsletters, and updating the IRWM website. Providing in-kind support could also include material contributions such as a venue for meetings or activities, use of a company vehicle, use of office supplies and/or equipment, and other appropriate forms of contribution. While managing in-kind support would require increased regional communication and collaboration, it furthers implementation of the Plan and represents a meaningful opportunity for small and/or disadvantaged entities to support RWMG's ongoing activities.

Connect Stakeholder Grant Funding Opportunities to the UFR Plan

When a project proponent pursues grant funding, the RWMG will encourage the proponent to include a budget line item that reflects the cost of RWMG administration and integration of the project outcomes into the Plan. The RWMG would need to coordinate and oversee this effort; this approach would necessitate an active membership to continuously secure grant funding.

Private or Foundation Funding

This is a limited option due to the difficulty of securing these types of grants for ongoing RWMG operations. However, it is still important to identify opportunities for this type of funding from public, private, and family foundations connected with the Upper Feather River watershed. Foundations often confine their grant funding to projects with clearly measurable outcomes and a definitive timeframe; however, the RWMG could request funding for a well-developed, program-level implementation effort.

Fee-For-Service

The RWMG could establish a fee structure for professional services such as technical or policy work for project implementation and/or compliance with the California Environmental Quality Act (CEQA), facilitation of public meetings, community education and outreach, and grant writing and administration activities.

State and Federal Grants

The RWMG may apply for IRWM planning grants to fund regular or technical updates to the Plan. Technical updates may be necessary before a regularly scheduled update in response to new IRWM Grant program guidelines and standards, changes in policies and regulatory mandates affecting the Plan, and emerging issues or new sources of information that significantly impact the Region .

Regardless of the specific funding sources utilized, established and reliable IRWM Plan revenue will increase the likelihood that funding entities outside the Region will understand that applicants are part of a RWMG that coordinates and integrates implementation projects, facilitates collaboration and capacity building among stakeholders, and provides for technical data sharing and cost-saving opportunities.

12.3 Project-Level Funding Sources

Successful IRWM Plan Implementation hinges on establishing reliable (consistent, secure, long-term) funding for the projects that implement the Plan. It is anticipated that non-DWR funding sources will be pursued in addition to funding that may be available through Proposition 1 IRWM opportunities, or any subsequent bonds. Due to the limited DWR funding available and the natural uncertainty associated with bond-based funding, pursuing diverse funding sources will be essential to propel longevity in IRWM Plan Implementation efforts.

The projects included in the UFR IRWM Plan are intended to implement the Plan and achieve Plan objectives. All 79 projects selected for 2016 IRWM Plan Implementation have been thoroughly reviewed (Chapter 9 *Project Development and Review Process*) and are considered eligible for IRWM grant funds by the RWMG. The project list for 2016 IRWM Plan Implementation projects and estimated costs is provided in Chapter 9 *Project Development* (Table 9-2); full project submittals are included in Appendix 9-3.

Updating the implementation project list within the Plan will be necessary as projects are funded and implemented, regardless of the source of funding.

The RWMG representative will track and research available funding options, using a strategy developed by the RWMG (Chapter 11 *Plan Implementation, Performance, Monitoring, Data Management,* Section 11.2.1).

The RWMG has established a process (Chapter 9 *Project Development and Review Process*) for selecting projects for IRWM grant funding. When an IRWM grant solicitation is announced by DWR, the RWMG will decide which projects to include in the grant application package on behalf of the UFR Region since only a limited number of projects can be submitted in any one round. Project proponents will be responsible for developing individual applications in response to solicitations.

Proponents of projects included in the Plan may pursue non-DWR funding independent of RWMG approval. When possible, such project funding proposals are encouraged to include a budget line item to incorporate the cost of RWMG administration and integration of the project outcomes into the Plan. Project implementation might result in water and wastewater rate increases; however, the IRWM process is specifically intended to help leverage funding from outside the Region to alleviate the financial burdens on DACs in particular.

Federal, State, Regional, and Private Grants and Loans

A wide variety of funding sources could be pursued by regional stakeholders to implement the projects that support the Plan. However, it is important to establish realistic expectations that can be accomplished over the next five years and that represent the current capacity level of the Region to successfully deliver. While special districts and municipalities could attempt to raise user fees to pay for new or improved services, these funding options are not realistic at this time given that many residents in the Region who earn less than the state's average household income do not necessarily have the ability to pay additional fees. In addition, local revenue bonds and other more complex financing options are not realistic at this time given the high percentage of DACs located in the Region. Therefore, the most realistic funding sources for stakeholders to pursue over the next five years may be federal, state, regional, and private grants and loans. The IRWM Plan projects will be implemented as appropriate funding sources become available.

Grant funding entities and their financial assistance programs are as varied as the regions and project needs they intend to serve. For example, DWR grant funding opportunities are organized into categories by project scope: environmental restoration, flood related, groundwater, IRWM, water quality/drinking water, water supply/management, and water use efficiency. In addition, projects may be eligible for grant funding from entities and programs that, on the surface, do not appear to fit the scope of IRWM implementation projects. For example, CAL FIRE has a State Responsibility Area (SRA) Fire Prevention Fund for projects and activities related to hazardous fuel reduction, fire prevention planning, fire prevention education, and training that reduce the risk and potential impact of wildfire on habitable structures in an SRA. This funding source could achieve multiple benefits such as reducing the wildfire threat to habitable structures, improving water quality in the UFR watershed through appropriate tree-thinning, and other healthy forest management activities that address a historically fire-based ecosystem.

A wide variety of needs in the Region --natural resources, infrastructure, DACs, wetlands and meadows, education, data collection, forest management and restoration, agricultural water efficiency, and capacity building--could be addressed through grants and loans. The RWMG and stakeholders may pursue the following funding sources to finance the implementation projects that support the IRWM Plan (costs associated with project operations and maintenance are addressed in Section 13.4):

State of California Funding Opportunities

- Proposition 1 IRWM
    - Planning Grants (Round 1)
    - Disadvantaged Community Involvement Program (Round 1)
    - Implementation Grants (includes funding for DAC Projects) (Round 2)
- Proposition 1E
    - Storm Water Flood Management Program
    - Early Implementation Program
- 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 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
    - Sierra Nevada Conservancy

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

- Natural Resources Conservation Service (USDA)
- 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
- United States Forest Service (USDA) Resource Advisory Committees (RAC) Safe Rural Schools Funding (intermittent appropriations)

Eco-Cultural Land Conservation Funding

- Administration for Native Americans
- California State Parks, Off-Highway Motor Vehicle Recreation Commission (OHMVR) Program
- Council on Foundations
- Environmental Grantmakers Association
- First Nations Development Institute
- Funding Exchange
- Indian Land Tenure Fund
- International Funders for Indigenous Peoples
- Lannan Foundation-Indigenous Communities Program
- National Park Service, Historic Preservation Grants
- Seventh Generation Fund for Indian Development
- The Christensen Fund
- US Fish and Wildlife Service, Tribal Grants

Resources and References for Native Land and Trusts & Conservancies

- Indian Country Conservancy
- Maidu Summit Consortium and Conservancy
- Native American Land Conservancy

Finally, the RWMG will track key entities that provide financial and technical resource assistance for current and upcoming funding opportunities:

- The Department of Water Resources (DWR) - Financial Assistance http://www.water.ca.gov/funding/
- Sierra Nevada Conservancy - Funding Opportunities for the Sierra Nevada Region http://www.sierranevada.ca.gov/other-assistance/funding-sources
- State Water Resources Control Board – Division of Financial Assistance http://www.waterboards.ca.gov/water_issues/programs/grants_loans/
- California Department of Fish and Wildlife - Proposition 1 Restoration Grant Programs https://www.wildlife.ca.gov/conservation/watersheds/restoration-grants
- State Water Resources Control Board - Financial Assistance Application Submittal Tool (FAAST) http://faast.waterboards.ca.gov/
- California Financing Coordinating Committee http://www.cfcc.ca.gov/
- State Water Resources Control Board - Drinking Water State Revolving Fund (DWSRF) http://www.waterboards.ca.gov/drinking_water/services/funding/SRF.shtml
- State Water Resources Control Board - Clean Water State Revolving Fund (CWSRF) http://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/
- USDA Rural Development www.rd.usda.gov/ca

12.4 Project Operations and Maintenance Funding Sources

In addition to demonstrating potential funding for project construction, an IRWM Plan must also contain a discussion of the potential funding sources for project operations and maintenance (O&M). O&M costs are not eligible for grant reimbursement by the IRWM grant programs and most other state financial assistance programs. The funding source for project O&M is generally included in the fee structure for providing a service. For implementation projects involving infrastructure replacement, O&M costs could be covered by the cost savings from the new infrastructure.

Securing funding for regular O&M activities is a common issue for rural IRWM regions especially when addressing the needs of disadvantaged communities. It will be challenging if not impossible for many DACs to recover full O&M costs for infrastructure improvement projects based solely on user fees. Therefore, other methods for addressing O&M costs must be identified for the many DACs in the Region since residents cannot afford increases in fees for services. The RWMG may consider addressing O&M costs for such projects through in-kind donations of staff time and equipment.

Given the diversity of project proponents and the scope of their respective projects, one method to address O&M costs for all IRWM Plan projects does not exist. However, there are intentional and natural opportunities for checks and balances during the grant application process and outside the IRWM process. The RWMG's process of selecting projects for DWR funding will include vetting each project's O&M funding. The project proponent must develop a project-specific funding strategy for the project's budget, including O&M costs, before submitting a grant application. The RWMG will also be involved in monitoring the performance of implementation projects, so as to measure the overall success of the Plan and to identify areas for improvement (Chapter 11 *Plan Implementation, Performance, Monitoring and Data Management*). Finally, municipalities and special districts will continue to be evaluated for their compliance with state and federal infrastructure standards as well as the applicable standards for financial accounting during state-mandated preparation of municipal service reviews by the Local Area Formation Commission (LAFCo).

CHAPTER 13.0 TECHNICAL ANALYSIS

13.1 Introduction

In November 2014, the Upper Feather River Integrated Regional Water Management Plan (IRWMP) Project Team issued a call for studies at each of the Workgroup meetings and on the Upper Feather River (UFR) IRWM Plan website. At the same time, the Project Team began collecting data and developing a database that would be posted on the website indefinitely and updated as new information became available.

Data were collected on a wide range of watershed management-related topics including, but not limited to, the following:

- Surface and groundwater sources and management
- Water quality
- Agricultural lands management and restoration
- Ecosystem conditions and restoration
- Flood and floodplain management
- Watershed conditions and management
- Fire and vegetation management
- Forest ecosystem conditions and management
- Stormwater management
- Wetlands
- Water supply assessments
- Hydrology and hydrogeology studies
- Land use management
- Recreation resources and plans
- Municipal service reviews
- Water and wastewater infrastructure studies
- Community vulnerability assessments
- Socioeconomic studies

Data on these topics include technical studies and assessments, monitoring reports, websites, document collections, maps, and legislation.

The following sections summarize the mandatory plans and other technical studies found during this data call and search, and evaluate the information for data gaps and applicability to the UFR IRWM Plan. The final section assesses how information, study methods, and analyses will be used by the Upper Feather Regional Water Management Group (RWMG) and public to understand watershed management conditions and needs over the 20-year planning horizon.

Appendix 13-1 includes a complete list of baseline data found to date, organized by topic area. This data list will continue to grow with the IRWM Plan process. Many topic areas overlap, and thus many of the data studies may be used in different functions throughout the IRWM planning process. As noted above, baseline information is also available on the IRWM Plan website (http://featherriver.org/catalog/index.php). The database is fully searchable, and in many cases an active web link to the referenced document is also available.

13.2 Review of Mandatory Documents

This section provides an overview of federal, state, regional, or locally mandated documents. A synopsis of each document is provided, along with an analysis of how the data will be used by the RWMG and public in the IRWM planning process.

13.2.1 Federal Resources

13.2.1.1 Forest Land and Resource Management Plans

The U.S. Forest Service (USFS) planning documents provide guidelines and management direction for the upper watershed regions of the Upper Feather 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; invasive 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 USFS 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 Upper Feather IRWM planning area includes all or portions of the Plumas, Lassen, and Tahoe National Forests and their respective land and resource management plans, all prepared by the USFS as follows:

- Plumas National Forest Land and Resource Management Plan (1988)
- Lassen National Forest Land and Resource Management Plan (2005)
- Tahoe National Forest Land and Resource Management Plan (2005)

These plans direct 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 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 include recreation, fish, wildlife, and sensitive plants, diversity, riparian areas, water, ownership, land uses, and the urban/wildland interface. The plans also present both forest-wide and area-specific management direction for national forest lands.

13.2.1.2 FERC Relicensing Documents

At least six hydropower projects in the Upper Feather watershed are undergoing, or will soon undergo, relicensing through the Federal Energy Regulatory Commission (FERC), including the following:

- Bucks Creek Project (FERC Project 619)
- Lake Oroville Project (FERC Project 2100)
- Poe Hydroelectric Project (FERC Project 2107)
- Rock Creek - Cresta Project (FERC Project No. 1962)
- South Feather Power Project (FERC Project 2088)
- Upper North Fork Feather River Project - Lake Almanor, Butt Valley Reservoir, and Butt Valley, Caribou 1&2, Belden, and Oak Flat powerhouses (Project 2105)

FERC relicensing often requires substantial supporting documentation in the form of biotic studies, flood risk assessments, recreational use studies, settlement agreements mandating in-stream flow requirements and resource management strategies for fish and wildlife protection, and other documentation. These auxiliary documents are useful in the preparation of IRWM Plans. For hydropower projects currently undergoing relicensing, websites catalog the various supporting documents in some cases, such as the Poe Hydroelectric Project with the State Water Resources Control Board (SWRCB) and National Oceanic and Atmospheric Administration; more than one agency may provide website support. FERC relicensing information is also readily available on its online library (http://www.ferc.gov/docs-filing/elibrary.asp).

13.2.1.3 Climate Change Resources

Several federal agencies have been involved in climate change research and planning documents, including the USFS, the U.S. Environmental Protection Agency (EPA), and the U.S. Army Corps of Engineers (USACE). Federally prepared documents that will be useful in climate change vulnerability assessments and adaptation strategies include the following, which can be found on the IRWM website:

- "Chapter 3: Climate Change and the Relevance of Historical Forest Conditions" from Managing Sierra Nevada Forests (USDA Forest Service, March 2012) discusses the current and future patterns of climate change in Sierra Nevada forests, biotic responses to climate change, the value of various management practices in ecosystem restoration, and the value of historical ecology in developing management practices. These resources can be used to help define regional climate trends.
- Climate Change Handbook for Regional Water Planning (U.S. EPA and California Department of Water Resources, December 2011) was developed as a partnership of the EPA Region 9, the California DWR, the USACE South Pacific Division, and the Resources Legacy Fund, specifically for the Integrated Regional Water Management planning process. Quantitative tools and techniques for addressing both climate change adaptation and mitigation (greenhouse gas reduction) are introduced and discussed in order to facilitate preparation of comprehensive IRWM Plans. A guide to assess the vulnerability of a watershed or region to climate change impacts is presented in this handbook, and guidelines to prioritize vulnerabilities are introduced. These resources can be used to help define vulnerabilities/strategies consistent with DWR guidelines.
- The Emissions & Generation Resource Integrated Database (eGRID) for 2010 (U.S. EPA, December 2010) is a comprehensive inventory of environmental attributes of electric power. The preeminent source of emissions data for the electric power sector, eGRID is based on available facility-specific data for all U.S. electricity generating facilities that provide power to the electric grid and report data to the U.S. government. eGRID can be used to calculate construction-related electric energy emissions in the planning area.

13.2.2 State Resources

13.2.2.1 California Water Plan

The California Water Plan (CWP) Update 2013 was prepared by the California Department of Water Resources (DWR) to define the statewide approach to water management, set state priorities, and provide guidance to water planners throughout the state. The CWP is a master plan that guides the orderly and coordinated control, protection, conservation, development, management, and efficient use of the water resources of the state. The CWP promotes regional water planning to integrate multiple water and resource management activities to meet a wide range of local objectives and is intended to help water agencies, local governments, and the state legislature promote and support integrated regional water management (such as in the preparation of IRWM plans). The CWP does not make project-specific or site-specific recommendations but instead provides a framework to guide local agencies. The 2013 CWP Update has new features that include a strategic plan with vision, goals, recommendations, and an implementation plan. It was developed with a different analytical approach than prior state water plans, and relies on extended information and tools, including use of water portfolios, regional reports, a protocol for future scenarios, and defined resource management strategies (RMS).

The CWP identified RMSs that should be used by the Upper Feather River RWMG and other stakeholders to develop the UFR IRWM Plan so that the Upper Feather RMSs are consistent with the state's priorities. Coordination of RMS with state priorities will also increase the competitiveness of IRWM Plan projects for future state funding.

A key objective of the CWP is to present a diverse set of RMSs to meet the needs of each region as well as statewide needs. The strategies can be adapted and combined within an IRWM plan region depending on climate, projected growth, existing water system, and environmental and social conditions. The proposed strategies should complement the operation of the existing water system within an IRWM plan region. The basic intent of the CWP is to help IRWM planning areas to prepare watershed management plans that satisfy regional and state needs, meet multiple objectives, include public input, address environmental justice, mitigate impacts, protect public trust assets, and are affordable.

Table 13-1. CWP 2013 Resource Management Strategies

Agricultural lands stewardship	Recharge area protection
Agricultural water use efficiency	Recycled municipal water
Conjunctive management and groundwater storage	Salt and salinity management
Conveyance–Delta	Sediment management
Conveyance–regional/local	Surface storage–CALFED
Desalination	Surface storage—regional/local
Drinking water treatment and distribution	System re-operation
Economic incentives (loans, grants, & water pricing)	Urban land use management
Ecosystem restoration	Urban runoff management
Forest management	System re-operation
Flood management	Urban land use management
Groundwater/Aquifer remediation	Urban stormwater runoff management
Land use planning and management	Urban water use efficiency
Matching water quality to use	Water and culture
Outreach and engagement	Water-dependent recreation
Pollution prevention	Watershed management
Precipitation enhancement	Water transfers

13.2.2.2 Sacramento River Basin Plan

The jurisdictional boundaries of the Central Valley RWQCB include the UFR IRWM planning area. As a tributary to the Sacramento River, the Upper Feather River is recognized in the Central Valley RWQCB's Sacramento River Basin Plan (2011) as a surface water body that requires monitoring and regulation. This basin plan identifies the beneficial uses of the Feather River, provides specific water quality objectives (including total dissolved solids, pesticides, and electrical conductivity), and lists illegal discharges into the Feather River.

Section 13240 of the Porter-Cologne Water Quality Control Act requires each Regional Water Quality Control Board (RWQCB) of the State Water Resources Control Board (SWRCB) to formulate and adopt water quality control plans, or basin plans, for all areas within the region. The Porter-Cologne Act also requires each RWQCB to establish water quality objectives to ensure the reasonable protection of beneficial uses and a program of implementation for achieving water quality objectives within basin plans. Beneficial uses and water quality objectives are also included in the State's water quality standards.

13.2.2.3 The 20x2020 Water Conservation Plan

The 20x2020 Water Conservation Plan (2010) was developed by a number of public resource agencies, including DWR, SWRCB, California Bay-Delta Authority, California Energy Commission, California Department of Public Health, California Public Utilities Commission, and California Air Resources Control Board. In 2008, Governor Schwarzenegger directed state agencies to develop a plan to reduce statewide per capita water use by 20 percent by the year 2020. The 20x2020 Water Conservation Plan sets forth a statewide road map that includes a range of activities to maximize the state's urban water efficiency and conservation opportunities between 2009 and 2020, and beyond These activities include improving an understanding of the variation in water use across California, promoting legislative initiatives that incentivize water agencies to promote water conservation, and creating evaluation and enforcement mechanisms to assure regional and statewide goals are met.

Using ten hydrologic regions as defined by DWR for water resources planning purposes, regional baseline and target values were derived for daily per capita water use. The 2005 statewide baseline urban water use value, expressed in gallons per capita per day (gpcd), is 192 gpcd. The statewide target for 2020 is 154 gpcd. This represents a statewide savings of 1.59 million acre-feet (MAF) based on a population of 37 million people. The Upper Feather River is in DWR's Hydrologic Region 5 (Sacramento River), with a baseline water use of 253 gpcd and a 2020 target of 176 gpcd. Residential users are the highest water users (174 gpcd). The 20X2020 Water Conservation Plan can be used in the IRWMP to describe existing water use, water conservation targets, potential statewide savings, and water conservation strategies.

13.2.2.4 Disadvantaged Communities Mapping Tool

The DWR has developed a mapping tool to help determine which communities in an IRWM region meet the Disadvantaged Community (DAC) median household income (MHI) definition. The maps and geographic information system (GIS) files are derived from the U.S. Census Bureau's American Community Survey (ACS) and are compiled for the five-year period 2006-2010. DAC status is determined based on the DAC definition provided in DWR's Proposition 84 and 1E IRWM Guidelines, dated August 2010. An MHI of less than $48,706 is the DAC threshold (80 percent of the statewide MHI). The GIS files used to generate maps are provided for those with GIS capabilities.

13.2.2.5 Groundwater Resources

Groundwater Information Center

The Groundwater Information Center, a website maintained by DWR (http://www.water.ca.gov/groundwater/), can be used to describe the relationship between groundwater and surface water.

Bulletin 118 and Related Resources

Bulletin 118 presents the results of groundwater basin evaluations in California. The Upper Feather River watershed is located within the Sacramento Valley basin and there are a number of groundwater sub basins within the region. Resources include the 2003 Update of Bulletin 118, region-specific bulletin reports, and groundwater basin maps and descriptions.

13.2.2.6 Climate Change Resources

Similar to federal agency involvement in climate change planning, several California State agencies have also been involved in climate change research and planning documents, including the California Department of Water Resources, California Energy Commission, and California Air Resources Board. State-prepared documents that will be useful in climate change vulnerability assessments and adaptation strategies include the following:

- Managing an Uncertain Future: Climate change adaptation strategies for California's water (California Department of Water Resources, 2008) provides a profile of the observed climate phenomena at the state level that have bearing on the region and provides adaptation strategies for addressing these phenomena. This document can be used for describing the existing climate change setting and in developing climate change adaptation strategies.
- Cal-Adapt – Exploring California's Climate Change Research (California Energy Commission) provides modeled climate trend graphs, precipitation decadal averages, and wildfire risk, with GIS imaging of all parameters. This information can serve as a source of comparison with other modeling of the watershed for high and low greenhouse gas (GHG) emission scenarios.
- California Climate Adaptation Strategy (California Natural Resources Agency, 2009) 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. This document can be used in the IRWM Plan process to help develop climate adaptation goals.
- The Climate Change Scoping Plan: A framework for change (California Air Resources Board, December 2008) calls for a reduction in California's carbon footprint by reducing GHGs to 1990 levels, or cutting approximately 30 percent from business-as-usual emission levels projected for 2020. Significant progress can be made toward the 2020 goal relying on existing technologies and improving the efficiency of energy use. A number of solutions are "off the shelf," and many –especially investments in energy conservation and efficiency – have proven economic benefits. Other solutions involve improving infrastructure, transitioning to cleaner and more secure sources of energy, and adopting 21st century land use planning and development practices. This scoping plan can assist in providing climate change adaptation strategies for the IRWM Plan.
- Proposition 84 & Proposition 1E Integrated Regional Water Management Guidelines (California Department of Water Resources, November 2012) provides IRWM Plan guidance on aspects of climate to be discussed, strategies to be considered, and assessment of GHG emissions to be included in IRWM Plans. It will be used for DWR compliance in the IRWM Plan process.

13.2.3 Local and Regional Plans

13.2.3.1 Urban Water Management Plans

The California Urban Water Management Planning Act of 1983 requires urban water suppliers that serve more than 3,000 customers, or that deliver more than 3,000 AF per year, must prepare and adopt an urban water management plan (UWMP). The act provides that urban water suppliers must prepare, adopt, and submit UWMPs to DWR in order to be eligible to receive funding for certain programs, including Proposition 50. An UWMP provides water management strategies for a service area as well as baseline data on water deliveries, supply and demand, supply reliability, and climate and precipitation statistics.

There are no applicable UWMPs within the UFR IRWM planning area. Just outside the UFR IRWM area to the west, the South Feather Water & Power Agency (SFWPA) has prepared an UWMP (2010) for its 31,000-acre service area, serving approximately 6,650 households in the Oroville area of Butte County. The SFWPA operates a hydropower project (South Feather Power Project, FERC License No. 2088) on the

South Fork of Feather River and Slate Creek. This project includes numerous reservoirs with a combined storage of 164,577 AF. Given that SFWPA operates water storage and hydropower projects within the UFR IRWM planning area, their UWMP will be a resource on the issue of exported water in the UFR IRWM Plan.

13.2.3.2 Agricultural Water Management Plans

The Agricultural Efficient Water Suppliers Efficient Management Practices Act of 1990 (AB 3616) defines state requirements for Agricultural Water Management Plans (AWMP), which are intended to document whether agricultural water is being used efficiently. The act also requires DWR to support and assist in implementing practices that increase statewide water use efficiencies. The DWR supports the Agricultural Water Management Council (Council), consisting of members of the agricultural and environmental communities and other interested parties.

An AWMP must be prepared as a requirement of the Central Valley Project Improvement Act (Central Valley Project contractors using water for agriculture are required to prepare AWMPs) or in accordance with the requirements of the Water Conservation Act of 2009 (SB X7-7) i.e., water purveyors who deliver water to more than 25,000 acres).

Although Plumas County alone had 162,000 acres of planted crops in 2010 per the 2035 Plumas County General Plan Update, there are no AWMPs in the UFR IRWM Plan Area. The region's water purveyors are not subject to either of the aforementioned state mandates for the preparation of an AWMP. It should be noted that Sierra Valley Resource Conservation District provides information on several agricultural water-related projects, including the Sierra Valley Agricultural Water Quality and Habitat Enhancement Project, and the Upper Long Valley Creek Agricultural Lands Improvement Project.

13.2.3.3 Groundwater Management Plans

Groundwater management is the planned and coordinated local effort to sustain the groundwater basin to meet future water supply needs. With the passage of Assembly Bill (AB) 3030 in 1992, local water agencies were provided a systematic way of formulating groundwater management plans (GWMP). AB 3030 also encouraged coordination between local entities through joint-power authorities or memoranda of understanding. Senate Bill (SB) 1938, passed in 2002, further emphasized the need for groundwater management in California. SB 1938 requires AB 3030 GWMPs to contain specific plan components to receive state funding for water projects.

In the UFR IRWM planning area, the largest groundwater basin is in Sierra Valley. The Sierra Valley groundwater basin experiences a wide range of water quality conditions, primarily associated with naturally occurring mineral constituents. The most affected portion of the basin is found in the central west side of the valley where fault-associated thermal waters and hot springs yield water with high concentrations of boron, fluoride, iron, and sodium. Although there are no GWMPs in the planning area, Sierra Valley has been the subject of many groundwater studies and management documents related to safe extraction quantities, water supply, groundwater level, and water quality, including the following:

- Sierra Valley Hydrogeologic Studies (2005)
- Results of the Fall 2005 Aquifer Tests in Sierra Valley (2006)
- Technical Report on 2005-2011 Hydrogeologic Evaluation for Sierra Valley (2012)

A number of studies on meadow restoration in the planning area, and the Feather River Watershed Management Strategy for Implementing the Monterey Settlement Agreement, which discussed groundwater recharge, are also useful in groundwater issues research.

As noted above, DWR's region-specific Bulletin 118 reports are also pertinent to local groundwater conditions.

13.2.3.4 City and County General Plans

California state law requires each city and county to adopt a general plan for its physical development, including any land outside its boundaries that bears relation to its planning. The California Supreme Court has called the general plan the "constitution for future development." The goals, policies and objectives contained in city or county general plans are intended to underlie most land use- and resource-related decisions, including those that affect water supplies and quality.

Of the seven mandatory elements that cities and counties must cover in their general plans, some degree of water management information is required in five of them:

- Land use
- Circulation
- Conservation
- Open-space
- Safety

In addition, many general plans include optional elements, such as public services, recreation, hydrology and water quality, agricultural resources, and climate change or GHG emissions. These optional elements also include water management data.

The City of Portola, one of only two incorporated cities within the IRWM Plan area, has adopted a Parks and Recreation Master Plan in addition to its general plan. Plumas County, the primary county within the plan area, is actively engaged in the IRWM planning process and RWMG, and has assumed the role of lead agency for the UFR IRWM Plan. Other jurisdictions with applicable general plans within the IRWM planning area include Butte County, Lassen County, and Sierra County. These plans and their applicable planning horizons are shown in Table 13-2 below:

Table 13-2. General Plans in Upper Feather IRWM Planning Area

General Plan	Year Adopted	Planning Horizon
City of Portola	2012	2020
Plumas County	2013	2035
Butte County	2012	2030
Lassen County	1999	2020
Sierra County	1996	2012

The Plumas County General Plan acknowledges that buildout of the general plan may deplete groundwater resources or interfere with groundwater recharge, and provides mitigation including the support of the IRWM Plan and groundwater recharge protection measures. It also indicates that implementing the general plan may result in development within dam failure inundation zones, a significant and unavoidable impact even with the preservation of floodplain areas and management of new development in hazardous areas.

General plans for the counties of Plumas, Sierra, and Butte include a "water resources element" that specifically addresses water sources, storm water management, water service providers, water storage facilities, the supply and demand of water, as well as each county's management efforts. Plumas County's

Agriculture and Forestry Element and Butte County's Agriculture Element will also be helpful in the preparation of the IRWM Plan. Both plans also contain discussions on GHGs in their Conservation and Open Space Elements.

It should also be noted that both the general plans and their corresponding EIRs are valuable resources in the IRWM planning process.

13.2.3.5 County Hazard Mitigation Plans/Emergency Operations Plans

The purpose of hazard mitigation plans (HMPs) is to better protect people and property from the effects of hazardous events or emergencies such as wildfire, flooding, and drought. Development of HMPs ensures a participating jurisdictions' continued eligibility for certain federal disaster assistance, specifically the FEMA Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation Program (PDM), and the Flood Mitigation Assistance Program (FMA). Completion also earns credits under the National Flood Insurance Program's Community Rating System (CRS) which provides for lower flood insurance premiums in CRS communities.

Hazard mitigation plans in the Upper Feather IRWM planning area include

- Butte County Hazard Mitigation Plan (May 2013)
- Lassen County, Susanville, Susanville Indian Reservation Hazard Mitigation Plan (March 2010)
- Plumas County Hazard Mitigation Plan (2016)

In the UFR Plan area, wildfire, flooding, drought, and infrastructure failures are the primary water-related hazards listed in the local HMPs.

13.2.3.6 Municipal Service Reviews

Under the Cortese-Knox-Hertzberg Local Government Reorganization Act of 2000 (Government Code §56000, et seq.), public agencies whose boundaries and governance are subject to Local Agency Formation Commission (LAFCo) must provide a review of public services--such as water, fire protection, and reclamation--every five years. An MSR provides comprehensive knowledge of available services, future needs for each service, and the efficiency and expansion capacity of service providers.

In the Upper Feather River IRWM planning area, the following MSRs are available as reference sources:

- Central Plumas Fire MSR (December 9, 2013)
- Eastern Plumas MSR (October 3, 2011)
- Lake Almanor MSR (October 15, 2012)
- City of Loyalton MSR (December 9, 2010)

The Lake Almanor MSR includes ten different providers of various services, while the Easter Plumas MSR includes 17 different service providers. In utilizing these sources, the determinations made for each service provider should be reviewed for information on adequate infrastructure, supply, and growth projections. Determinations on water, wastewater, fire, and recreation services should specifically be reviewed for water-related issues.

13.2.3.7 Water Supply Master Plans

There are no local mandated water supply master plans or water supply assessments under Senate Bills 610 and 221 in the Upper Feather River IRWM planning area.

However, the Plumas County Flood Control and Water Conservation District (Plumas County FCWCD) has co-sponsored at least two watershed management plans. The Plumas County FCWCD, a water district governed by the Plumas County Board of Supervisors, delivers municipal and irrigation water supplies from the State Water Project and promotes watershed restoration and management in the Upper Feather River Region It is also serves as the grantee for the current Upper Feather River IRWM Plan Update and for various Proposition 50 IRWM associated projects.

13.2.3.8 Watershed Management Plans

A number of local watershed management plans have been prepared within the UFR IRWM planning area, including the following:

- Feather River Watershed Management Strategy for Implementing the Monterey Settlement Agreement (2004)
- Feather River Coordinated Resource Management Group Annual Reports (2005-2013)
- Coordinated Resource Management Plan for the East Branch of the North Fork Feather River (1989)
- Lake Almanor Watershed Management Plan (2009)
- Coordinated Resource Management Plan for the Feather River (1996)
- The Delta Plan (2013)

These documents establish priorities for watershed management and restoration actions. The watershed plan goals include improving temporal retention of water, increasing base flows, reducing sedimentation, protecting streambanks, improving upland vegetation, improving groundwater recharge, and providing adaptive management solutions. These plans will be integrated into the UFR IRWM Plan in terms of watershed management strategies, adaptive management approaches, goals, and identified or perceived conflicts among water users.

13.3 Review of Other Data

A systematic search for information on watershed management and planning in the UFR IRWM planning area has uncovered approximately 200 data sources (a number that is growing as the IRWM Plan process unfolds) for use in the UFR IRWM Plan. Some of these sources are mandatory or legally required documents as specified in the scope of work for this Technical Study, but many are not.

Non-mandatory source material is also useful in the research and writing of watershed management topics covered in the IRWM Plan and are included in a brief discussion here. Most are primary sources of information such as scientific studies, non-profit organization (NPO) generated technical studies, document collections (such as the Climate Adaptation Knowledge Exchange, an NPO website that includes case studies, adaptation plans, and climate adaptation tools), legal documents, U.S. Census documents, and monitoring reports. These documents cover a range of topics that can be generally categorized as follows:

- Biotic studies and assessments
- Climate change case studies, adaptation plans, vulnerability assessments, and planning tools
- Demographic information/DACs
- Flood studies
- Forest and wildfire studies
- Planning laws
- Recreation-related documents
- Restoration studies

- Stream flow studies
- Water quality studies and monitoring reports
- Watershed assessments

Given the large number of non-mandatory data found, Appendix 13-1 contains a synopsis of these documents by category.

13.4 Analysis of Data Gaps

This technical document review identified several data gaps that should be addressed in the IRWM Plan as well as over the long-term, in planning for the Upper Feather watershed area:

- Conjunctive water use and conjunctive water management resources
- Recreation planning resources
- Water supply and management plans

These data gaps are discussed in further detail below.

13.4.1 Conjunctive Water Use & Management Resources

More data and studies are needed on conjunctive water use and conjunctive water management strategies in the planning area.

Conjunctive water use is an approach that recognizes the hydrologic connection between surface water and groundwater so as to manage the overall water supply more efficiently. Methods for conjunctive water use can consist of groundwater use by individuals to supplement limited surface water supplies, or it can consist of regional water management programs that store large volumes of surface water below ground during normal and high rainfall years in order to pump groundwater from storage during drought years. Both types use surface water and groundwater together to improve the overall availability and reliability of water supply. The IRWM planning process would benefit from a review of existing conjunctive water use practices in the Upper Feather IRWM planning area, as well as recommendations for potential new conjunctive water use practices that could ease water supply and reliability issues.

Conjunctive water management engages the principles of conjunctive water use, where surface water and groundwater are used in combination to improve water availability and reliability. However, conjunctive water management also includes important components of groundwater management such as monitoring, evaluation of monitoring data to develop local management objectives, and use of monitoring data to establish and enforce local management policies. Scientific studies are needed to support conjunctive water management. They provide important data to understand the geology of aquifer systems, how and where surface water replenishes the groundwater, and flow directions and gradients of groundwater. These types of studies would benefit the IRWM planning process and should lead to conjunctive management strategy recommendations in the IRWM Plan. To support this effort, a water balance study is being prepared by Plumas Geo-Hydrology as part of the work plan for the IRWM Plan Update.

13.4.2 Recreation Planning Resources

Recreation plans are significant in the context of IRWM planning when recreation relates to water consumption (e.g., irrigation for parks) and water use (e.g., rafting, boating, and fishing).A survey of recreation documents in the planning area uncovered one recreation use survey on Little Last Chance

Creek, a Parks and Recreation Master Plan for the City of Portola, and a database of recreation documents on an NPO site. The following additional agencies provide recreation services in the IRWM planning area:

- Eastern Plumas Recreation District
- Whitehawk Ranch Community Services District
- Almanor Recreation and Park District

No recreation plans for these districts were found. Given the lack of recreation use documents for primary water bodies in the planning area, the IRWM outreach process will need to include informational interviews on recreational use of water bodies in the plan area.

13.4.3 Water Supply and Management Plans

State-mandated water supply documents and legislation such as the 20X2020 Water Conservation Plan, Senate Bills 610 and 221, and the State Water Resources Control Board's "Notice of Surface Water Shortage and Potential for Curtailment of Water Right Diversions for 2015" will impact water supply discussions during the IRWM planning process. Other valuable resources related to water supply include groundwater management plans for some of the groundwater basins in the local valley areas, local general plans and general plan EIRs, and municipal service reviews. A data gap is identified, however, in terms of agricultural water management plans, drought action plans, and comprehensive water supply planning documents for the larger planning area that might match in scope the level of information provided in an urban water management plan.

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